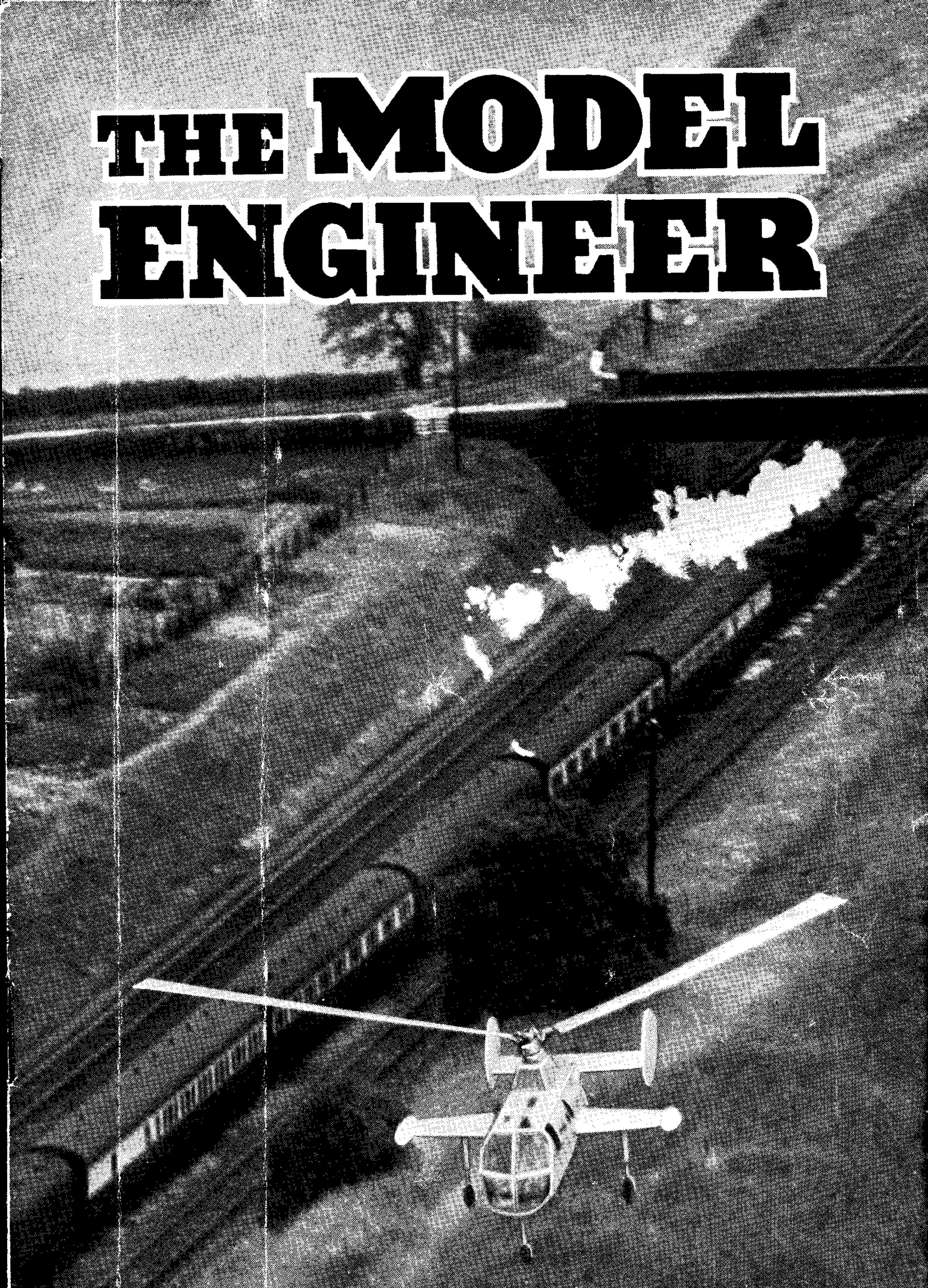

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The MODEL ENGINEER

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31ST MARCH 1949 VOL. 100 NO. 2497

SMOKE RINGS

Our Cover Picture

● A RECENT development in helicopter design is the subject of our cover picture this week. It is the Fairey Gyrodyne, photographed during a flight from White Waltham, Berks, aerodrome. This interesting machine made its first "airborne" hop on December 7th, 1947; then, on June 28th, 1948, it established a new International Speed Record for helicopters by flying at 124.3 m.p.h. over a 3-kilometre course.

The high speed of the Gyrodyne is a direct result of its configuration; the propeller on the starboard stub wing contributes forward thrust as well as counteracting torque from the rotors. That is to say, the rotors provide sustenation while the propeller provides forward thrust.

From Norway

● WE WERE very pleased to receive recently a photograph and drawings, together with a constructive description of a handsome model beam engine, and we think that many readers will be glad to share our pleasure: accordingly they are all reproduced on other pages in this issue. The model has been built by Mr. A. Ebeltoft, of Narvik, Norway, a place which won considerable fame during the war. The original article was written in Norwegian and has had, therefore, to be translated into English, which accounts for the slightly strange wording. We believe, however, that it is perfectly clear and instructive.

Mr. Ebeltoft seemed to be concerned about the fact that the drawings are dimensioned in metric measurements, and he suggested that they should be converted into English measurements. We have decided to leave them as they were, and for two reasons: first, English model-makers are not entirely ignorant of the metric system, and, secondly, we think that it will be found that the assembly of all the various parts will be less troublesome if the original dimensions are used. We have had some experience of working to dimensions which have been converted from the metric system, and know what trouble they can give in some of the finer details! Both systems of measurement have their advantages if worked to separately and consistently; but the conversion of one to the other can, and does, lead to exasperating trouble, especially in the clearances between moving parts.

Who Knows Haybutton?

● ONE OF our American readers, Warren G. Ogden, Jnr., spends his leisure hours making authentic models of examples of early English craftsmanship. Readers may recollect that a picture of one of his beautiful embossed model cannon appeared on the cover of THE MODEL

ENGINEER on April 1st last year, and like us, may have been surprised at the wealth of historic information which he provided.

Mr. Ogden is now interested in modelling early English anvils, and we have been able to supply the address of one of the firms whose name he gives, but so far we have failed to trace a Mr. Haybutton who he names as another English manufacturer of anvils. If any reader has knowledge of an anvil maker of this name we should be very pleased to pass on any information to our American friend.

The Feminine Touch

● THE REALISTIC photograph reproduced on this page shows a fine 36-in. span, line-controlled Vickers "Viking" aircraft built by Mr. H. A. Gibbs, of the High Wycombe and District Society of Model Engineers. As can be seen, it is truly a twin-engined job, as it is fitted with two miniature i.c. engines; in other respects, it is very true to scale, and is even equipped with a properly retractable undercarriage.

At a first glance, however, one of the main features is the excellent appearance of the external finish and painting. We understand that Miss Roma Morgan was responsible for this part of the work, and it certainly does her credit. She possesses a sure touch and a remarkably accurate eye for detail, qualities which were essential for so excellent a model as this one. Incidentally, Miss Morgan is a member of the High Wycombe society, and we shall be interested to see some more of her handiwork in due course.

Why a Club was Formed

● IN THE course of an interesting letter, Mr. J. W. Bailey, of Loughborough, Leics, records the somewhat novel story of how the Loughborough Model and Experimental Engineering Club came to be formed. He states that he has always been an interested model engineer and had a "O" gauge railway, before the war. At the outbreak of hostilities, he had to sell what equipment he possessed and "hope for the best."

While he was in the Army, he married, and after his discharge he bought a house. Then he felt that he could think of model engineering again; but when he surveyed the situation, he found that the circumstances to be met were: (1) no room; (2) no money to spare, and (3) he was determined to get going somehow!

He could not believe that he was the only one in this position, so he thought of forming a club. A preliminary meeting was called for July 1st, 1948, and twelve other enthusiasts attended. A temporary committee was formed, and a series of subsequent weekly meetings led eventually to an inaugural meeting, on October 12th, in a clubroom which had been found in the meantime.

The club meets at frequent intervals, and is now actively preparing for its first exhibition which will be held in the Town Hall lecture-room, Loughborough, on April 28th, 29th and 30th.

Mr. Bailey's address is 267, Beacon Road, Loughborough, and we wish his club all success in the future.

The West Midlands Federation

● WE HAVE lately received news from Mr. Ronald Addenbrooke, the hon. secretary, which shows that the West Midlands Federation of Model Making Societies is soundly established. The first quarterly meeting was held in Birmingham early in January, and the discussion dealt with such matters as legal requirements regarding hydraulic tests on model locomotive boilers, insurance of locomotive tracks and boilers, effects of the Town and Country Planning Act on members' workshops, car and locomotive tracks, etc. Exhibition dates reserved were: June 3rd, 4th and 6th, Worcester; June 16th, 17th and 18th, Tamworth; October 20th, 21st and 22nd which, so far, are only provisionally fixed, Coventry.

The membership at present consists of the Birmingham, Coventry, Leicester, Marston Green, Rednal, Sutton Coldfield, Tamworth, Worcester and Wrekin Model Engineering Societies, representing approximately five hundred individual members. This is certainly an excellent beginning, and we are sure that if there are other societies in the West Midlands desiring to join the Federation, Mr. Addenbrooke will be pleased to hear from them; his address is 30, Emmanual Road, Wylde Green, Sutton Coldfield, Warwick.

SOMETHING UNUSUAL

A 2-in. Scale Model Huwood-Hudswell 100 h.p. Diesel Mine Engine

by F. Surgey

TOWARD the end of 1947, I thought I would turn to something new and unusual, and it was with this in mind that I began looking for details for a fresh model.

As a colliery maintenance machinist, I was particularly interested in some new types of mining equipment being designed to help improve the production of coal, and it was while looking through a periodical of mining machinery that I came across a picture of an 0-4-0 underground diesel mine locomotive. This was all the inspiration I required, and so I immediately wrote the firm concerned, but without success.

I then asked one of our colliery managers if he had any information or pictures and he sent me a picture of a totally different make of locomotive, this time an 0-6-0, 100 h.p. diesel locomotive. I wrote to the firm concerned (actually the distributors), and they very kindly supplied me with a booklet of pictures and description together with about half-a-dozen main dimensions.

This was the beginning of what I now look upon as one of the most interesting jobs I have ever tackled. Having studied the job thoroughly, I proceeded to draw the locomotive as best I could from available measurements to a scale of 1 in. to 1 ft. and it was then I realised that I must make the model larger than this to make a really worth-while job. I then decided to draw the model in 2-in. scale and it was to this scale that I eventually constructed the model. I wrote once more to the distributors telling them of what I intended to do, and they supplied me with more details and a set of superb clear, glossy photographs of the locomotive from every angle, and I was to find that these helped considerably during the construction later. Having filled in a few more details on my drawings, I then drew various separate full-size drawings for wheels, axles, frames, buffer-beams, patent couplers, etc., and after this I commenced work.

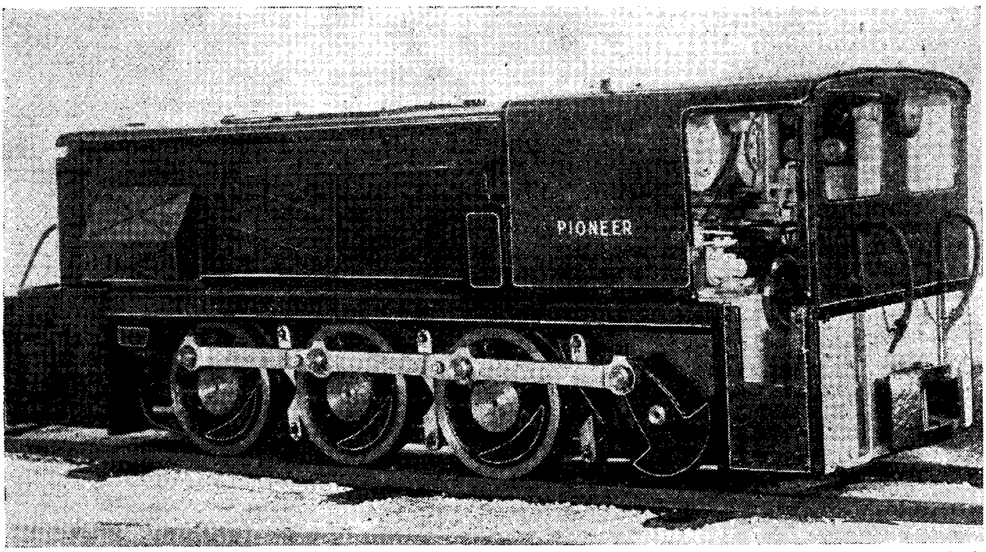


Photo by] [J. Leonard Waller

A rear view, showing cab details, compressed-air tanks, and flexible shaft to speedometer in roof, gearbox reversing lever, instrument panel, handbrake wheel and Westinghouse valve

The first job was to make a pattern for the wheels, and sent it to the local foundry who made a very good job of the castings. Next I cut the buffer-beams and main frames from $\frac{3}{16}$-in. plate and after a good deal of heavy drilling, sawing and filing, I managed to get them to my satisfaction. I also cut some steel angle for bolting buffer-beams to frames, together with cab lower frame, floor and front beam from $\frac{1}{8}$-in. and $\frac{3}{16}$-in. plate, respectively. I decided to use ball-bearings in place of normal axleboxes as in prototype, mainly because the model may be

required to run, perhaps, for many hours without attention while on exhibition.

I bolted the frames together, as in usual practice, and drilled them as far as I could, though I had to drill many holes later when I had fitted some of the parts.

When working this way, I realised the tremendous help when building a model locomotive given by "L.B.S.C.'s" clear and precise drawings for they do save a terrific amount of work when one can set out all holes as per drawing, and know that the model has not to be dismantled to put in further holes. Having drilled frames, I set about machining wheels and axles. These were done on a modern "Willson" 7-in. all-geared head lathe which is a treat to handle; unfortunately, it does not belong to me, but is part of our N.C.B. workshops. Later, I machined crankpins, bearing housings, rear crank axle or gearbox axle, together with rear drive cranks which were turned from solid mild-steel and sawed, cut and filed to correct shape. I then drilled bolt holes in bearing housings and fitted these to frames.

The next job was to drill the machined wheels for crankpins, and after fitting these, the complete wheels and axles with bearings were bolted to frames together with the rear crank axle assembly. Connecting-rods were next started upon, and these when completed were fitted with brass bushes and then tried on crankpins. Having fitted these satisfactorily, I turned eight small collars for the ends of the crankpins. These were later drilled and fitted with small taper cotters, as in actual practice.

Patent couplers were rather difficult in design to reproduce. There are many designs, depending on the existing types of mine cars to be hauled. Some are steel castings and some are prefabricated from plate. In this case they are steel castings. I built mine from a combination of $\frac{1}{8}$-in. steel plate, brass plate and copper tube, these in turn being welded, soldered, and riveted together. The coupling-pin slides in a rectangular slot strengthened at both top and bottom. This was made by bending the copper tube (softened) over a former. These were sweated to brass plate, and these in turn riveted at top and bottom of the main coupler body of $\frac{1}{8}$-in. steel plate. The completed couplers were then drilled and bolted to front and rear of buffer-beams and later the pins were turned from $\frac{1}{2}$-in. round mild-steel, the whole being very rigid and pleasing to look upon.

Next came the exhaust conditioner tank sides of plate and dummy inspection covers; also the filter outlet through which the exhaust gases pass into the atmosphere on the actual locomotive. It may be helpful at this point to explain that, in actual practice, the exhaust gases have to be purified by this conditioner system so that when the gases reach the atmosphere down the mine they are perfectly harmless and conform fully to the Mines Regulations.

At this stage, I decided it was time to fit the motive-power, in my case a small electric motor 250-volt a.c., and gearbox. After many hours of experiment, I was successful, though owing to the high revs. of the motor, the unit was noisy. I have quietened it by fitting rubber pads under motor and gearbox.

Readers may wonder why I fitted electric drive. The main reason is because this is more suited for exhibition purposes, and all halls in our area are wired for the standard 250 volt a.c.

At present, the locomotive is run by being packed clear of rails, though I may run it on track later is desired. It has no hauling-power, as far as live passengers are concerned.

Motor and gearbox are located in about the same position as the diesel engine, that is near the centre of the bonnet, the drive to wheels being taken to the front pair and not to crank-axle. It was about this time that I had a conversation with one of the firm's chiefs, and was able to find out some of the uses of the many fitments of the locomotive and, in particular, that the flanges of the centre pair of wheels should be turned off to negotiate the rather sharp curves often found in colliery track. This meant taking out the centre pair of wheels and treating them likewise. Having done this, I decided to leave the chassis for a spell and work on the radiator and bonnet.

The radiator is built up from $\frac{1}{16}$-in. steel plate and welded together. The grille is from brass gauze, the whole unit being made to bolt to the bonnet. The bonnet sides were next begun, and as they are both different, I made two separate drawings for these. They are made from brass and tinplate soldered and riveted together, while inspection-doors were made and fitted by means of hinges of small copper tube. The doors are ribbed for strength and, in my case, I did this by soldering copper wire across diagonally and filing to shape. This effect is very pleasing and I was asked recently how I had managed to beat the ribs in the sheet; so the finished job must be very convincing! At the forward right-hand side, the section fitted with ventilating louvres was then soldered together from sheet and fitted to bonnet side.

The top of bonnet was then cut and bent to shape. The large rectangular hole was cut, the plate to cover this being packed up with washers to allow air to pass through when it was bolted in position.

Water- and oil-tank caps were turned from brass and mounted on top of the bonnet and radiator. The cab front was next cut from $\frac{1}{16}$-in. plate, windows were cut out and angles bent to shape were riveted on, to bolt the bonnet sides and top to. The whole bonnet unit, complete with radiator was then assembled and holes were drilled along the bottom edges for the angle which fastens the bonnet to footplate.

Strips of steel plate were cut for the footplate which extends right to the cab and inside to cab front beam. These were fitted to chassis by means of small angles and, when bolted on the bonnet, fixing holes were marked and drilled. Other holes drilled were for air pipes, sandboxes and horns etc., which were bolted on later.

The cab was begun by first making the rear plate which bolts on to the top of the rear buffer-beams. Holes were drilled and windows cut out together with a $\frac{1}{2}$-in. diameter hole between windows for the large electric light. After this plate was fixed in position, dead measurements were taken for cab sides and roof which are formed as a one-piece unit. This was cut from

plate and bent to shape, afterwards being fitted to footplate by means of small angles. This particular plate was made so that it could be easily detached for easy access to cab interior for fitting and painting controls.

I was by now progressing very well, and the model really began to look well.

At about this time, I decided to have a try at drawing the cab fittings, but found that the information I had, did not give very much help. Once more I wrote for details. The firm were very obliging and sent word that they would obtain some drawings from the actual builders Messrs. Hudswell-Clarke of Leeds.

As I had still plenty to do, I decided to begin the job of building the smaller details, and fitting these to the model. First, the brake gear: hanger brackets were turned from 1-in. mild-steel and bolted to chassis. The brake hangers were cut from mild-steel bar and fitted on these. Brake blocks were turned from a bush, being afterwards cut off, shaped and fitted to hangers.

Steel bars turned down at the ends were fitted to the bottom of hangers which were drilled to take $\frac{3}{16}$-in. B.S.F. screwed rod for adjustment of brakes. Small inverted brackets were fitted between front exhaust conditioner tank and leading pair of wheels to take brake-shaft arms which operate the brakes. These are worked by either the handwheel brake-screw or, in actual practice, the Westinghouse brake cylinder. In my case, they are operated by the former, the arms being coupled together by long rods from cab handwheel screw to arms on front bracket. On the top of the footplate, the dummy horn and sandboxes were fitted in front of the cab. Below footplate, were fitted the forward sandboxes, and to these and the ones in front of cab the dummy compressed-air operated sand-valves were cut and shaped, soldered and bolted to underside of boxes by means of small flanges.

Copper tube formed the dummy air-pipes at front and rear, the forward ones extending some way down the footplate, the rear ones coming from under the cab floor. Flexible tubes were soldered to these and small clamps bolted on at the joints of both ends of tubes. The open ends of flexible tubes were fitted with dummy valves and chain to secure them to the buffer-beams. The squared rod projecting from the casing with ventilating louvres in it was next made and fitted being bolted at front end by means of a small bracket. The small knob and triangular plate were fitted at the base of the radiator.

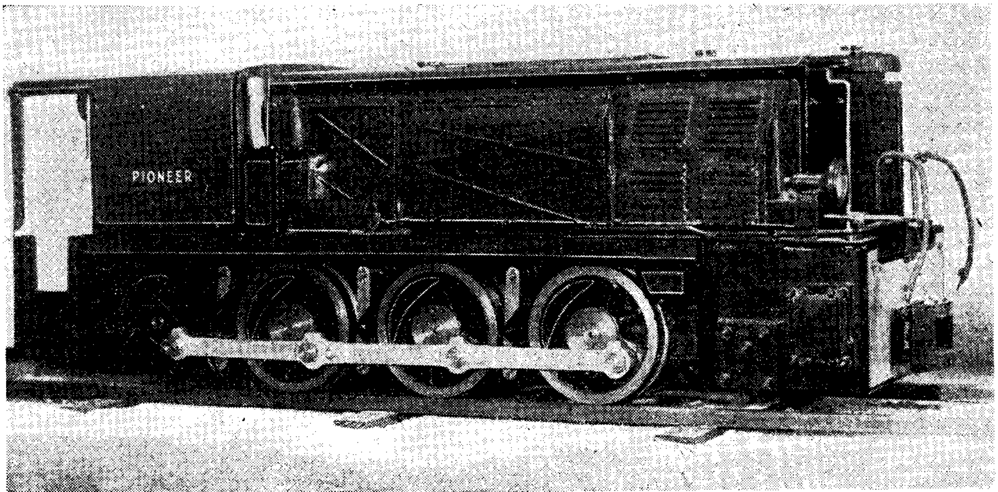


Photo by] [*J. Leonard Waller*

A front view, showing front exhaust conditioner tank and filters. Compressed-air horn is on footplate in front of cab sandbox

By this time, I had received some further drawings of the cab interior. Still some of the main details were missing and as I knew that the work in cab would enhance the model considerably, it was arranged for me to visit the works at Leeds to obtain the necessary information to complete the job. This was indeed an interesting visit, though this particular type was not under construction at the time. The very complicated mass of machinery was explained to me, the firm's representative made a list of things I wanted and measurements in particular and promised to send them along.

A few days later, I received the information I wanted and so, with a tremendous burst of enthusiasm, I again set to work. I had once more to resort to the drawing board, as the firm's drawings were in various scales ranging from 1 in. to 1 ft. to full-size and none of them 2-in. scale. I began on the compressed-air cylinders; they were made from steel tube turned to size, the larger two being bolted to roof by means of straps and the smaller ones on either side of cab being fitted likewise. The ends of these tubes were sealed with mild-steel blanks and turned to correct shape, the top main cylinder ends being turned to represent flanges. Bolts and nuts were fitted to these flanges to give the necessary accurate appearance.

The dummy gearbox was next built up and fitted between frames. Mounted on this is an inspection-plate, a gear oil pump, several bearing housings and a small crank-arm at the top which, in the prototype operates the reverse mechanism. All these were bolted in position using an equal number of bolts as on the actual job as far as I could see from photographs. The brake handwheel and screw, together with the fixing bracket for cab front beam, were next made, the handwheel being machined from solid mild-steel and the spokes drilled and filed out.

A dummy speedometer was turned from brass and fitted with a flexible shaft. Close to this is the cab light mounted on another bracket so as to shine on the instruments and controls.

The head and tail lights were next turned from solid brass and fitted in position, the whole three lights being later fitted with 4-volt pea-bulbs. Pressure-gauges, five in all, were turned from brass and fitted to instrument panel. This was later bolted on but not till interior of cab had been painted. In the roof are also bolted three dummy electric switches. The Westinghouse brake valve and the compressed-air sand-valve were built up in brass with steel handles and, together with the connecting pipes, were fitted to rear of cab. Other cab fittings such as the three-speed gear change mechanism and various tubing for the air supply were added, as were the two tubes for the fuel and water gauges. Pressure-gauge and speedometer were fitted with their respective clock faces and glass (celluloid) windows fitted into the grooves turned for same in all these instruments. Some of the cab parts were bolted to the footplate and others to the one-piece roof and sides so that the cab could be carefully painted and then bolted in position before the outside was painted.

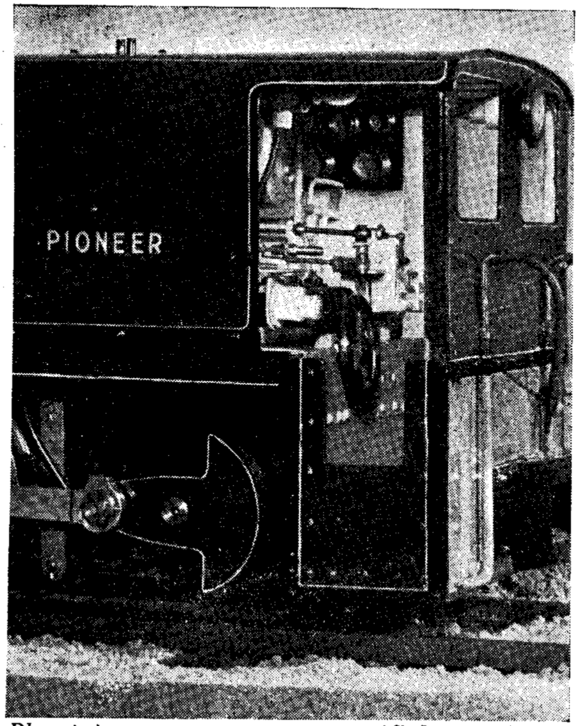


Photo by] [*J. Leonard Waller*

A view of the cab, showing instrument panel

Now came the final stage of painting, a stage which from my experience has to be approached and worked upon very carefully. I decided to proceed very cautiously, experimenting on odd wheels and metal sheets for a start. The actual locomotive is, I understand, painted in battleship grey and it was here that I decided to depart from the original, and to paint the locomotive in mid-green and black with cream lining and red buffer-beams. The first stage was to paint the locomotive in a priming coat of grey though some of this was done during the process of construction ~~as were~~ the frames painted black before the wheels were fitted. As an experiment, all bright parts were painted with a coat of cellulose varnish and this has been successful in keeping off rust up to the present time though how long it will remain effective will not be seen yet. After rubbing down the first coat of grey, the inside of the cab was given two coats of cream and the gearbox a coat of brown. The instrument panel was stained and polished and fitted together with instruments on the right-hand side of the cab, after which the cab was fixed permanently to the footplate.

The whole locomotive was then marked out for lining and the coat of mid-green was applied to wheels, bonnet sides and top together with cab sides, cab rear above buffer-beams, air conditioner tank, footplate valance and sandgear. Black was then painted on cab roof, bonnet and other parts of chassis not yet painted including footplate and patent couplers. The buffer-beams were painted two coats of red and the whole left to dry thoroughly before commencing the black lining which was applied with a good-quality small brush. I experimented with the lining and used both a draughtsman's pen and a fine lining brush. For lettering I used transfers as I think that they are much better than paint unless one is an expert. The perfectly formed transfer letters can be moved and spaced several times to get the required result. Finally, the whole locomotive was smoothed down with fine abrasive-cloth and the finish-coat of clear varnish applied.

The locomotive was then mounted on a base packed clear of the rails and clamped down ready for its first show. This was only for one day, but I was there all the time and, believe me, I have never been asked so many questions in one day in all my life. The exhibition was packed from

(*Continued on page* 376)

A Modified Index for the M.L.7

by "Tyro"

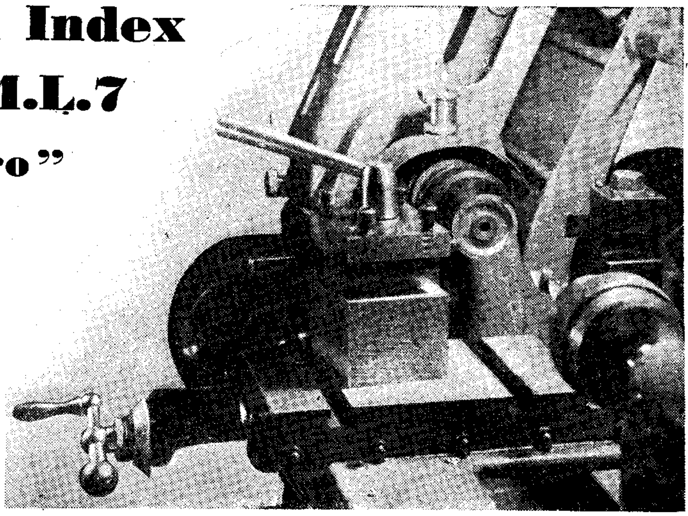


Photo by] [*W. M. Boulton*

Photo No. I. *Showing the micrometer dial nut screwed "back to front" on the stub mandrel*

ALMOST as soon as I had experienced the thrill of unpacking my M.L.7 and setting it up on its stand, I was asked to execute a semi-repetition job to help a friend in dire distress. The more I examined the various ways and means of helping my friend, the clearer it became that the job would be enormously simplified and speeded up by the provision of an adjustable index to the lathe cross-slide. I was therefore faced with the problem of producing a serviceable index really quickly, even if only for use as a stop-gap, until at a later date I had time to make something more elaborate. The resulting device, however, has been so successful that even now, almost twelve months later, I have no desire or need to make anything better and have turned up duplicates for my top-slide and milling-slide for the expenditure of a few pence and an hour and a half's work.

The device simply consists of converting the micrometer dial nut supplied with the lathe to fit over a sleeve of the same length, threaded internally to screw on to the end of the cross-slide feed screw, and externally to receive a knurled locking ring, which with a spring interposed, secures the micrometer dial in any desired position.

The method of manufacture was as follows, but I would at this juncture draw attention to my *nom-de-plume* which was not assumed without good reason! First a stub mandrel was indicated, and so a short length of $\frac{1}{2}$-in. brass rod was chucked and faced and a bare $\frac{1}{4}$ in. in length turned down and threaded $\frac{1}{4}$ B.S.F. by means of a die held in the tailstock die holder. A parting tool was then used to neck the last $\frac{1}{16}$ in. of thread to ensure that the micrometer dial nut screwed fully home on to the shoulder. Next the micrometer dial nut was screwed firmly "back to front" on to the stub mandrel as can be seen in photograph No. I. The boss so exposed was then machined off with a knife tool and a slight recess formed with a diameter of $\frac{3}{4}$ in. The central hole was then opened out with a small boring tool to slightly under $\frac{1}{2}$ in., followed by a $\frac{1}{2}$-in. drill held in the tailstock drill chuck. The drill was really employed as a form of reamer and was put through until the tip could be felt contacting the end of the stub mandrel. A parting tool secured in a back toolpost was then brought into play and the micrometer dial was parted off from the nut portion as close up to the dial as possible. The dial ring, as it had now become, was then reversed and gripped very lightly in the three-jaw chuck and the face skimmed and another slight recess formed to receive a $\frac{3}{4}$-in. $\times$ $\frac{1}{2}$-in. fibre washer of which more anon.

The sleeve was then made by chucking in the three-jaw a short length of $\frac{3}{4}$-in. brass rod which was faced and centre drilled and a No. 4 drill put through to a depth of $\frac{3}{4}$ in. and tapped $\frac{1}{4}$ B.S.F.

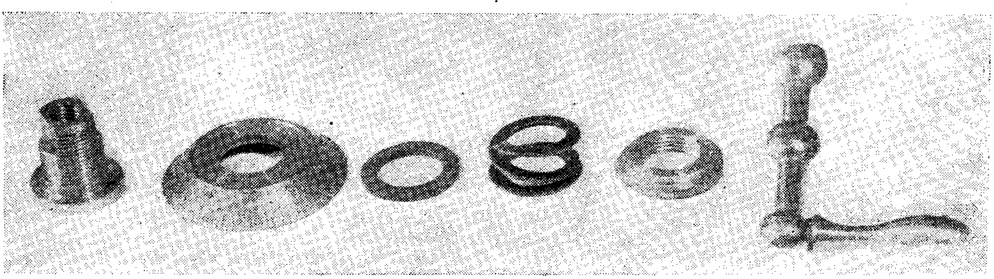


Photo by] [*W. M. Boulton*

Photo No. 2. *Exploded view of the components*

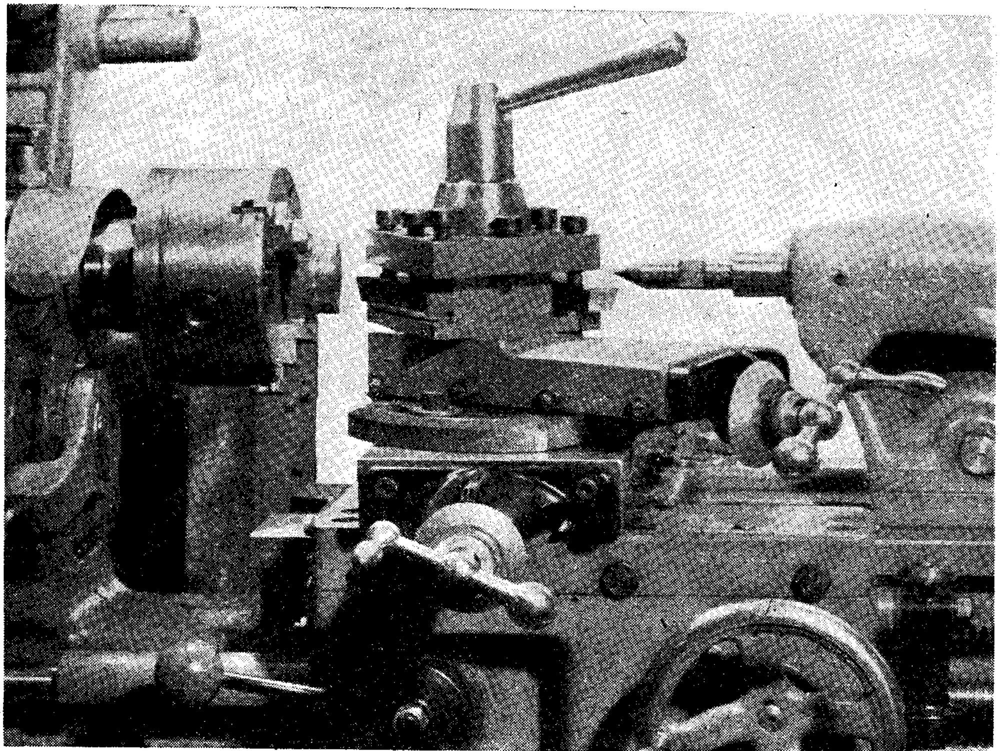


Photo by] [W. M. Boulton

Photo No. 3. Showing two finished indices assembled in position

with suitable taps supported by the back centre. Next a length of $\frac{1}{2}$ in. was turned down to $\frac{1}{2}$ in. diameter so that the micrometer dial ring fitted accurately over it and the recess previously formed in the back of the dial ring also registered with the full diameter of the rod. All but $\frac{1}{8}$ in. of the $\frac{1}{2}$ in. diameter was then reduced still further by a few thousandths and threaded $\frac{1}{2}$ in. × 26 t.p.i. again by a die held in the tail-stock die holder. This was successfully accomplished with a bit of a struggle, but no doubt the copy-book method would have been to screw cut the threads in the lathe. Two spanner flats to fit a $\frac{3}{16}$-in. Terry thin spanner were then filed on the end of the sleeve with the aid of a filing rest similar to that described by "Duplex." The sleeve was finally parted off 19/32 in. long.

All that now remained was to make a slim knurled locking ring in light alloy $\frac{3}{4}$ in. diameter and $\frac{1}{8}$ in. thick and threaded internally $\frac{1}{2}$ in. × 26 t.p.i., and a fibre washer $\frac{3}{4}$ in. in diameter to fit the recess on the face of the dial, with its hole a fraction under $\frac{1}{2}$ in. so as to be a press fit on to the register of the sleeve. This point was worth observing as there was then no tendency when assembled, for the fibre washer to move round with the dial when it was being adjusted independently of the sleeve, and so tend to tighten or loosen the locking ring. I like my index to be adjustable instantly against a firm pressure and so I fitted a flat-sided coil spring between the locking ring and the fibre washer, but for those who prefer an index to be locked positively, the spring can be dispensed with and the locking ring made a trifle thicker.

The coil spring shown in Photo No. 2 was obtained from an ex-R.A.F. surplus stores and the ball handle is a genuine Myford!

Something Unusual

(*Continued from page* 374)

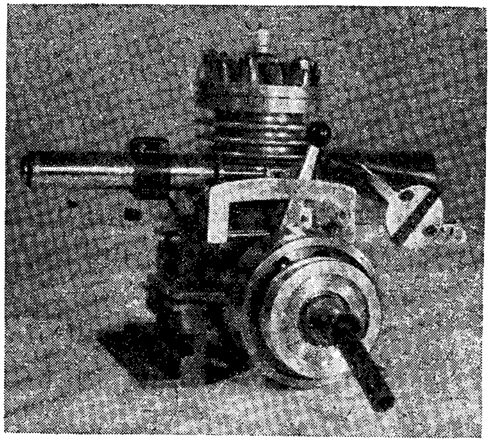
opening at 2 p.m. to closing at 8 p.m., nearly all these people connected in some way with mining. They wanted to know all about both the real and model locomotive, too.

I have found that the actual locomotive is at work at a modern colliery not many miles from my home so I hope to be able to examine this and its sister-engine at some time in the very near future. I am also informed by Messrs. Hudswell-Clarke the builders and Messrs. Hugh Wood & Co. the distributors that, beside these two, there are only three more of this particular type in existence. Two are at Lothian Colliery and one at West Bokaro Colliery, India, the latter being the first British-built mines diesel locomotive to be shipped to that country.

TWO RACING ENGINES

by G. A. Nurthen

(Photographs by R. Purvis)



THE two 25-c.c. engines illustrated are identical and intended for use in model racing hydroplanes. They are $1\frac{1}{4}$ in. bore $\times$ $1\frac{1}{4}$ in. stroke—2-stroke with rotary valve admission and fitted with built-up submerged jet carburettor, of E. T. Westbury's Atom "R" type. (THE MODEL ENGINEER, August 10th, 1939.) The engines are of my own design, the patterns being made by myself, and castings in D.T.D. 424 alloy by the Headingley Motor and Engineering Co. Ltd.

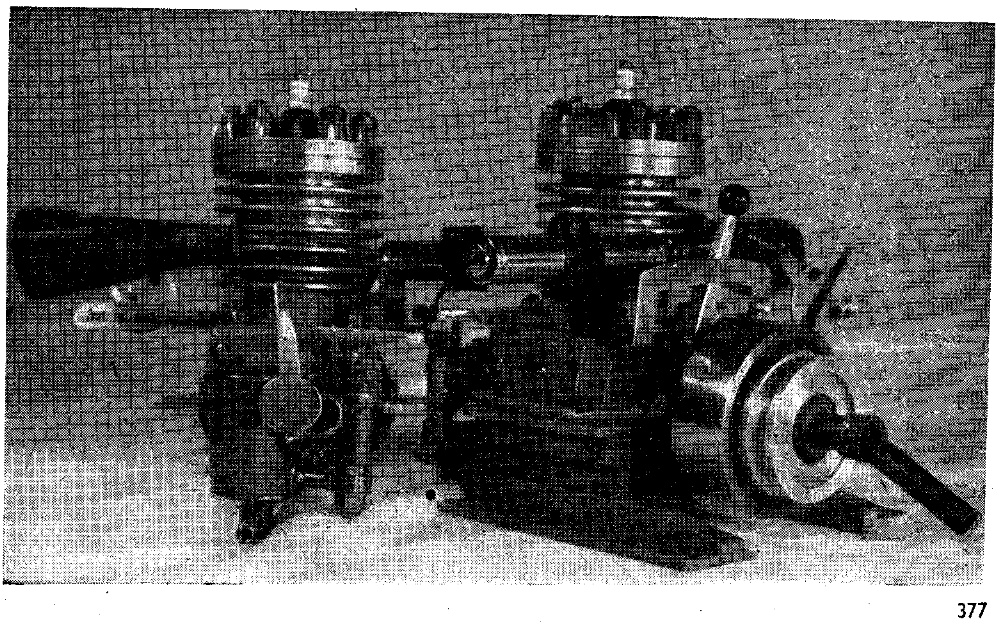
The crankshafts are of Nickel chrome steel and each crankshaft runs in a $\frac{1}{2}$ in. ball-race and a white metal crankcase bearing. The rotary valve, which is incorporated in crankcase cover, is driven by a follower pin inside the crankpin.

Connecting rods and pistons are of duralumin, and two rings 3/32 in. wide $\times$ $\frac{1}{16}$ in. thick are fitted to each piston. Oil dashpots, which enable the engines to be slowly automatically advanced, are connected to timing levers.

The carburettor float chamber on one engine appears to be drunk in the illustration, but as the engine will be inclined in the hull, and the latter will alter its trim when planing this should bring it just about vertical.

The performance of these engines is excellent, and running on a mixture of Methanol and castor oil, 9,000 r.p.m. has been obtained. (I have tried one engine in a hull with a propeller of 3 in. diameter $\times$ 5 in. pitch in water.) Given a good priming of fuel, the engines are "first pull" starters and running on a rich mixture of petrol and castor oil, with ignition fully retarded, they will "tick" over at less than 2,000 r.p.m.

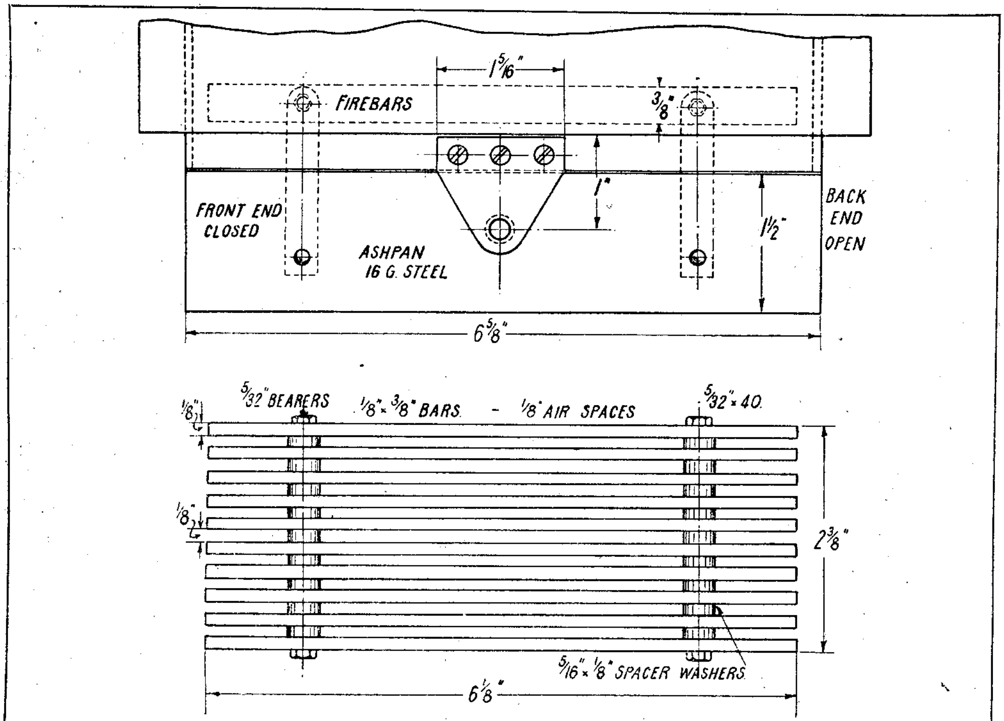
The weight of one engine, as shown, is 4 lb. 2 oz.; Height to top of plug, 6 in.; and length from carburettor to coupling, $7\frac{3}{4}$ in.



Grate and Ashpan for "Maid of Kent"

by "L.B.S.C."

THE grate and ashpan of a little locomotive should, wherever possible, be completely detachable. Not only is this necessary for cleaning out the inside of the firebox, dumping the residue of ash and clinker which accumulates after every run, and other "service needs," but it renders easy the replacement of the firebars when they are badly burnt. They can be renewed in a matter of minutes; whereas with an ordinary non-detachable type of grate and ashpan, the whole boiler has to come off, and it might take several evenings' spare time. The next best thing is to arrange for a section of the grate to hinge on a bearer, so that it can drop into the ashpan and let out the residue of the fire through the back of the pan; but this is not so convenient as removing the whole issue. I have seen plenty of locomotives in which the space underneath the ashpan was cluttered up with brake beams and rods, pipes, and other impedimenta, making it impossible to let the ashpan drop clear; but on the "Maid of Kent," both pipes and brake rods can be run at the sides, and the whole grate and ashpan dumped as one unit, merely by pulling out one solitary pin. What is more, it can be replaced just as easily, with the engine standing on the rails. I have the arrangement described below, on my Webb compound "Jeanie Deans," and it gives complete satisfaction.



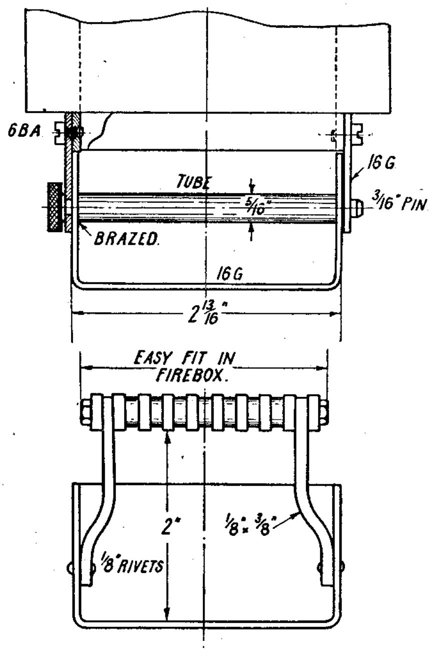
"Maid of Kent"—grate and ashpan

The grate is composed of ten firebars, each measuring 6⅛ in. long, ⅜ in. deep, and a thickness of ⅛ in., and can be made from commercial black strip-steel. The bars are spaced ⅛ in. apart, giving a total air space of a little over half the grate area; this is more than the air-space-to grate-area ratio of a full-sized engine, but is necessary to prevent the fire becoming choked. After cutting to length, mark off and drill one bar, with a No. 20 hole at 1 in. from each end. Use that bar as a jig to drill all the others.

To make the spacers, chuck a piece of 5/16-in. round mild-steel in the three-jaw; face, centre, and drill down 1 in. or so with No. 20 drill. Part off ⅛-in. slices until you reach the end of the hole; then repeat the process until you have fourteen of them. The four legs which support the grate, are made from pieces of steel, same section as firebars, but 2⅛ in. long. One end is rounded off and drilled No. 20; the lower part of each, is bent to the shape shown in the cross-section. The bearers are 2⅝-in. lengths of 5/32-in. round mild-steel rod, screwed 5/32 in. by

40 for a little over $\frac{1}{8}$ in. length each end. As 5/32 in. by 40 nuts are not made commercially, drill out four $\frac{1}{8}$-in. or 5-B.A. steel locknuts, with No. 30 drill, and tap them 5/32 in. by 40.

To assemble, put a nut on one end of each bearer, then a firebar, then one of the legs, with the bend to the outside; then bars and spacers alternately until you get to the last but one, then the second leg, with the bend the opposite way to the first, then the last bar, and finally the nut. Leave this loose until the second bearer is in at the other end, then tighten both nuts well, and rivet over the ends of the bearers a little, so that the nuts cannot slack off. If the assembly doesn't fit easily in the firebox, file the ends of the bearers a little, until it does.



How to erect the "Maid's" grate and ashpan

It is more than likely that advertisers who supply castings and material for these engines, will be able to furnish cast grates, with bars of almost triangular section, tapering from the full $\frac{1}{8}$ in. wide at top, to about $\frac{1}{16}$ in. at the bottom. These are preferable in every way to grates built up from cut bars, as they not only resist burning out, but keep much cleaner, as ash drops away more readily. They will need four legs fitted to them, same as above; the legs may be fitted between the end bars at each side of the grate, at about 1 in. from the end, and secured with $\frac{1}{8}$-in. screws put through the outer and second bar, and the end of the leg between them.

Ashpan

The ashpan is made from 16-gauge steel. Cut out a piece $8\frac{1}{8}$ in. long and $5\frac{13}{16}$ in. wide. Scribe a line down it $1\frac{1}{2}$ in. from each side, and across one end. Cut out the two corners, then bend on the lines, to the shape of a box with one end open; braze the corners. Alternatively, cut the piece $6\frac{5}{8}$ in. long and $5\frac{13}{16}$ in. wide; scribe the side lines, bend up to a channel shape, and braze a separate piece into one end. The top edges of the ashpan should line up with the bottom of the firebox.

Next, cut out two triangular brackets from 16-gauge sheet-steel, to the size and shape shown in the illustration. At 1 in. from the top edge, drill a No. 11 hole. Drill three No. 34 holes at $\frac{3}{16}$ in. from the top edge, and after setting the bracket in mid-position at the side of the firebox, attach it by three 6-B.A. screws running through these holes into tapped holes in the firebox plate.

How to Erect

Set the grate centrally in the ashpan, with the legs touching the sides, and the bottom of the bars 2 in. above the bottom of the ashpan. Clip legs in position with toolmakers' cramps, then drill a No. 30 hole through ashpan and leg, and put a $\frac{1}{8}$-in. iron rivet in each. Put the ashpan in place between the brackets, with the grate central in the firebox, and the upper edge of the ashpan hard up against bottom of firebox. Run the No. 11 drill through the holes in the brackets, making corresponding holes in the ashpan. Remove same, open out holes to $\frac{5}{16}$ in. diameter, and fit a piece of tube of 18-gauge, or else drill up a piece of $\frac{5}{16}$-in. rod with No. 11 drill. Insert this into the holes in the ashpan, and braze in position, filing of flush each side, and countersinking the ends.

The fixing pin is merely a piece of $\frac{3}{16}$-in. round steel, about $3\frac{3}{8}$ in. long, bevelled a little at one end, and furnished with a turned button at the other. The complete grate and ashpan assembly is pushed up in place, till the tube lines up with the holes in the brackets; the pin is then pushed through the lot, and will keep it in place by friction alone. To dump the fire, all that is needed is to bring the engine over the "ashpit"—a small section of the line where the cross-sleepers have been removed, and replaced by a longitudinal one under each rail—and pull the pin out. How to put the grate and ashpan back, is obvious!

Grate and Ashpan for the "Minx"

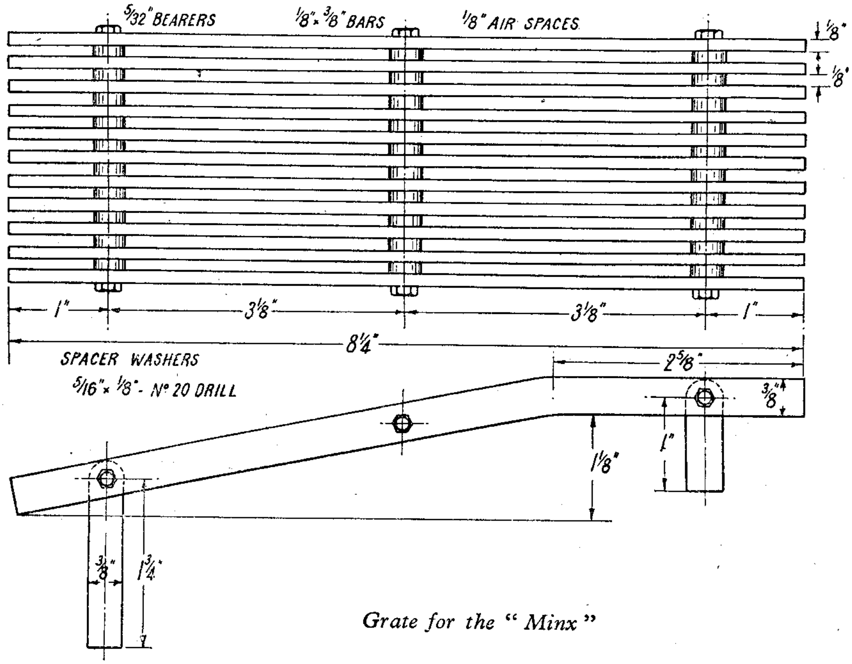
In the case of the goods engine, the same arrangement cannot be used, because of a "nigger in the woodpile" in the shape of the trailing axle. However, it is fairly easy to circumvent this merchant, and the following notes and illustrations show how it can be done. In the first place, we need a set of firebars that follow the contour of the bottom of the firebox. If the bars are cut over length to start with, and each one gripped in the bench vice about $2\frac{3}{4}$ in. from the end, a few judicious clouts with a hammer will put the necessary kink in. This is where a cast grate scores, because the bend is formed in the casting. Anyway, if you are building up the grate, see that all the bends are exactly to the same angle; then proceed to make up the complete grate, just as described for the "Maid." Note that you need three bearers, and 26 spacers, as the grate has eleven bars, and they are a little too long to leave unsupported in the middle, as the heat would cause bad distortion, and allow

live cinders to fall into the ashpan. Four legs are used as before, two of them being long, and two short—what the kiddies call "bunnylegs."

The ashpan is a sort of "semi-hopper," and is made from 16-gauge mild-steel sheet, a piece 8$\frac{5}{16}$ in. by 8$\frac{3}{4}$ in. being needed. It is made in three pieces, one forming sides and bottom, one the front, and one the sloping back. Starting from the 8$\frac{5}{16}$-in. edge, mark the outline of the side of the ashpan as shown in the illustration, and cut away the unwanted metal; then bend to the shape shown in the cross-section. Note—the outside dimension is 2$\frac{3}{4}$ in. wide at the bottom, to fit easily between the axleboxes; but the upper edges are splayed out just a little, to fit nicely between the side sheets of the firebox. We can't butt this one up against the bottom edges of the firebox sheets, as it would not go into place; it has to enter the firebox at the back end, in order to get the sloping part of the bottom, into position over the trailing axle. Make-up pieces are brazed into each end. That at the front end is "solid," and goes from the bottom of the pan, right to the top edge. The plate at the back stops short 1 in. above the bottom of the pan, thus leaving a hole 2$\frac{3}{4}$ in. long and 1 in. wide for air to enter. The grate is erected in the ashpan by the same method used for the "Maid," viz. splaying out the legs until they touch the sides of the pan, then clamping temporarily whilst they are secured by $\frac{1}{8}$-in. iron rivets. See dotted lines in illustrations of assembly, both side and end views.

How to Fit the Assembly to the Firebox

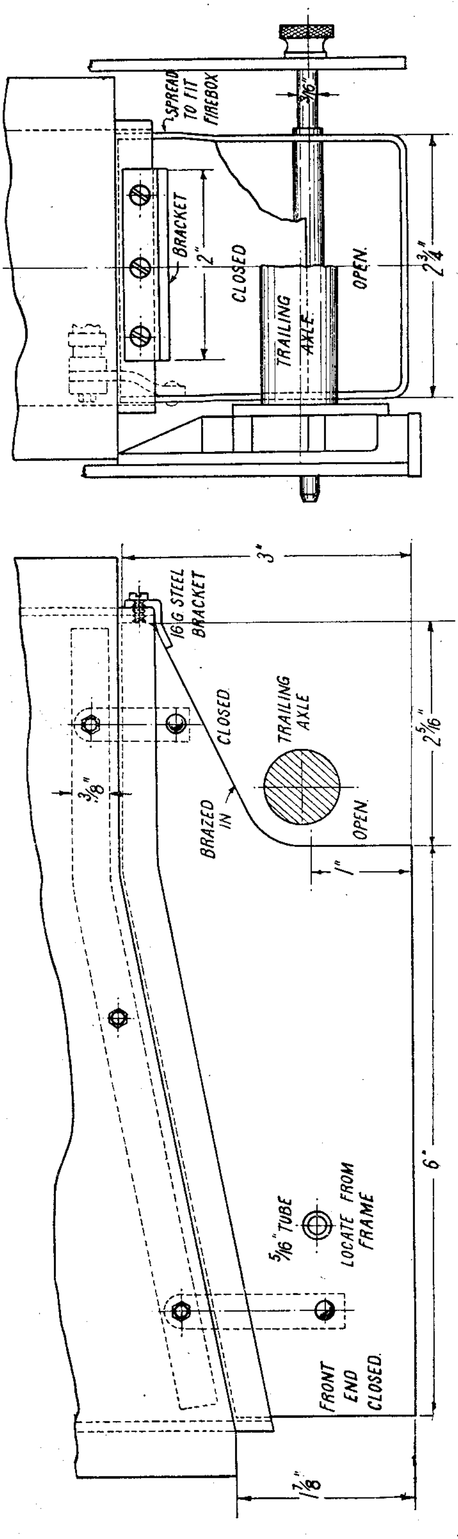
The back end of the ashpan is supported by a sheet-metal bracket held to the bottom of the doorplate by three $\frac{1}{8}$-in. or 5-B.A. screws, whilst the front end is supported by a pin passing through both main frames, and a tube in the ashpan itself, similar to the "Maid's." The bracket is made from a piece of 16-gauge sheet steel 2 in. long and $\frac{7}{8}$ in. wide. Bend this at a right-angle, lengthwise, at $\frac{3}{8}$ in. from one edge; then ease off the longer bend approximately to the angle of the ashpan. No need for "mike measurements," however! Attach the bracket to the



Grate for the "Minx"

bottom of the doorplate below the foundation-ring, by three $\frac{1}{8}$-in. or 5-B.A. screws, as shown in the end view.

At approximately 4$\frac{5}{8}$ in. ahead of the trailing axle centre, and $\frac{1}{8}$ in. below its running position, drill a $\frac{3}{16}$-in. clearing hole in the main frame at each side; No. 12 is the right size drill. Now put the grate and ashpan assembly in position, easily done by inserting the rear end into the firebox first, ahead of the trailing axle, then tipping up the front end, and letting the rear end fall into position on the bracket. Prop up the ashpan so that the bottom is parallel to rails, and then run the No. 12 drill through the holes in frame, and make corresponding holes in the ashpan. Be sure to hold the brace so that the drill is perfectly square with the frame. Remove ashpan, open out the holes to $\frac{5}{16}$ in., and fit a tube as described for the "Maid of Kent"; but in this case it is an advantage to let the ends project slightly beyond the ashpan, and either bell or countersink the ends. The ashpan is then located easier, when replacing after the fire, or rather the residue from same, has been dumped in the ashpit. The pin is merely a 5-in. length of $\frac{3}{16}$-in. mild-steel rod, furnished with a knob at one end, and slightly bevelled off at the other.



How to erect grate and ashpan on the "Minx"

The illustrations show the complete assembly. If a cast grate is used, the whole doings is erected in the same way, the only difference in detail being, that the legs are fitted between the first and second bars of the casting, and attached by screws.

First Trial Run

The working parts, with the exception of brake gear, being now complete, it is advisable to give the engine a trial run before proceeding any further with the job. Any alteration or adjustment needed is far easier to make before the cab, splashers, and the rest of the "trimmings" are erected. It is also advisable to be quite certain that the engine can *go* all right, before making provision for *stopping* it! I know of more than one case in which a locomotive provided with elaborate brake gear, was such a poor performer that a matchstick under the driving wheels would have formed an effective brake. However, I guess that the followers of these notes can do better than that; and have often enjoyed a number-one-size chuckle when a raw beginner wrote and told me that he got up steam for the first time, and to his great amazement, the engine not only steamed and pulled all right, but was far more powerful than I had ever claimed! "Honestly, I couldn't believe that I had built it" were the actual words.

All you need for a trial trip, will be something on wheels to ride on, and a tin can or small tank of some sort, for water. An eight-wheeled car is, of course, preferable, and it doesn't matter what gauge, if you are going to run on a multiple-gauge road. If you haven't a car and can't borrow one, a simple bit of 1-in. board about 3 ft. long and 6 in. wide, with four wheels running in plain "plummer-block" bearings, will do at a pinch. Fix a strong eye in the end, by which you can couple the car to the drag-beam of the engine by a loop of stout wire. Don't rely on a hook; she will pull it open. Solder a couple of tabs on to the water can, at the bottom, so that you can screw it down to the seatboard and prevent it falling off.

For the water connections, solder a bit of $\frac{1}{4}$-in. pipe into the side of the can near the bottom, for the pump feed; keep it company with a small plug cock, similarly soldered into the can, but furnished with a short bit of 5/32-in. pipe for a rubber-hose connection to the injector feed pipe. Solder a bit of $\frac{3}{16}$-in. pipe into the side of the can, near the top, for connection to the by-pass valve. A box to carry some coal and a temporary shovel bent up from sheet steel, complete the running tackle.

Fill the boiler to about three parts up the gauge-glass. Oil all the moving parts, and fill the mechanical lubricator nearly full with a good brand of cylinder oil suitable for use with superheated steam. I am now using Vaughan's "Cyltal 80 S" and find it gives excellent results, protecting the bronze cylinders perfectly from "redhot" steam; but "Vacuum 600 W," or any other good brand, can be used. I don't advise the use of automobile engine oil, for this reason—it doesn't "cling." Our I.C. friends have often chaffed me over this, saying that if the oil will stand up to the heat in an I.C. cylinder, "redhot" steam is just "small potatoes" to it. Quite so;

but what they overlook is that in a high-speed I.C. engine, the oil flies around in a spray that constantly washes every moving part. In a locomotive cylinder, pistons and valves move only comparatively slowly; and what is needed, is an oil which will cling to the moving surfaces, no matter how slowly the engine moves. Proper "superheater" oil does just that; motor oil won't. Give the ratchet wheel a few turns by hand, to "prime" the pump and ensure it working.

Steam can be raised on charcoal or wood chips, putting a bit of rag or waste wetted with paraffin, in the firebox, to start a blaze; or some of the fuel can be wetted. If you haven't an auxiliary blower (any of the various types that have been described, will do) couple a motor-tyre pump to the hand pump union under the drag-beam—it is only a few minutes' work to make an adapter—and use the engine's own blower by pumping air into the boiler. As soon as there are a few pounds of steam, the blower will work "on its own." Disconnect the tyre pump, throw a few shovelfuls of coal over the fire, and you are—if a first-timer—all set for one of the biggest thrills of your life.

Hints to the New Driver

When the blower starts to buzz a bit, and there is about 40 lb. on the "clock," it is time to warm her up. Put the lever in full forward gear and open the regulator about half-way. If she doesn't start to move, it will be the steam condensing in the cold cylinders; help her a turn or two by hand, standing clear of the chimney, as she will spit out the condensate, and it will be dirty. Then she will go; let her run light for a minute or so, to warm the cylinders. Now give her a few more shovelfuls of coal, evenly all over the fire; fill the water can, take some coal aboard (if on a continuous track) sit on the car, spreading your weight evenly, so that you don't sit over one pair of wheels, shut the blower, and open the regulator a little. *Don't gingerly tap the handle*; grab it like a full-sized driver, so that you have proper control. The engine will, if your workmanship is of average standard, start readily, and rapidly pick up speed, with sharp healthy sonorous puffs, very different to the feeble "chiss-chiss" so often heard on club and exhibition tracks. Pull the lever back, next notch to middle; adjust regulator to suit the speed you want to go, and you're all set to "keep on keeping on," as long as the coal and water lasts. You'll get tired long before the engine does!

Almost as soon as you get under way, the boiler will start to blow off. As you have only just fired up, open the door a little. Take a look at the water-gauge; if the water is below half-glass, shut the by-pass valve. You can see if the pump is working, as immediately the valve is closed, water will cease to run from the top pipe in the water can. If the steam pressure falls a few pounds, shut the firehole door again. Try to regulate the by-pass valve to keep the water-level practically constant. Now look at the fire; if it is incandescent all over, pop a little more on and shut the door. Never let the fire go down; one of the great mistakes made by raw recruits, is firing at the wrong time. Don't wait until the steam pressure falls before firing; the proper time to fire, is when the coal in the box is all bright red, or nearly white, and the boiler is just going to blow off. Little and often, should be the motto. Because "Maid of Kent" has a deep firebox, you don't have to fill it nearly to the crown sheet; a fire from 1 in. to 1½ in. deep is plenty, according to the coal used. Anthracite works best with a thin fire. The top part of the "Maid's" firebox is intended to act as a combustion chamber. Keep the fire as even as possible.

The best time to operate the injector, is when she is going to blow off. Turn the water on full, and as soon as it trickles from the overflow, open the steam valve wide. If properly made, the overflow will give one spit and then dry up, the injector singing like a linnet as it puts the H_2O in. If the overflow dribbles whilst feeding, close the water-valve a shade until it stops. Provided that the fire is normal, the injector will not have any effect on the steam pressure, running or standing.

New drivers should bear in mind that on a continuous track, it is a sign of bad enginemanship to keep juggling about with regulator and lever, constantly varying the speed, and making the engine snatch at the load. As soon as my own engines reach the normal safe speed on my own road, I let both regulator and lever severely alone, just looking after the fire and water. Consequently, I get pleasant trouble-free runs. On a straight up-and-down line, it is better to work in full gear, and control speed with the regulator; constant starting doesn't give the engine a proper chance to operate under expanded steam.

When finishing a run, let the fire die down, but don't run to the last gasp. Shut down with about 20 lb. on the gauge, let the engine cool off, then dump the residue of the fire.

A Novel Steam Locomotive

SOME brief particulars of Mr. O. V. S. Bulleid's new "Leader" class engines for British Railways Southern Region have recently become available. The design is a radical departure from orthodox practice in several important particulars. The boiler and engines are mounted upon two 6-wheeled bogies, the wheels of which are 5 ft. 1 in. diameter. The firebox has no water-legs; the two engines, one for each bogie, are of special 3-cylinder, sleeve-valve design; most of the moving parts are totally enclosed in an oil-bath, and coupling-rods are replaced by chains. The boiler, coal-bunker and water-tanks are enclosed in an air-smoothed casing, at each end of which a driving-cab is provided, ensuring that the driver has an entirely uninterrupted view of the road whichever way the locomotive is travelling.

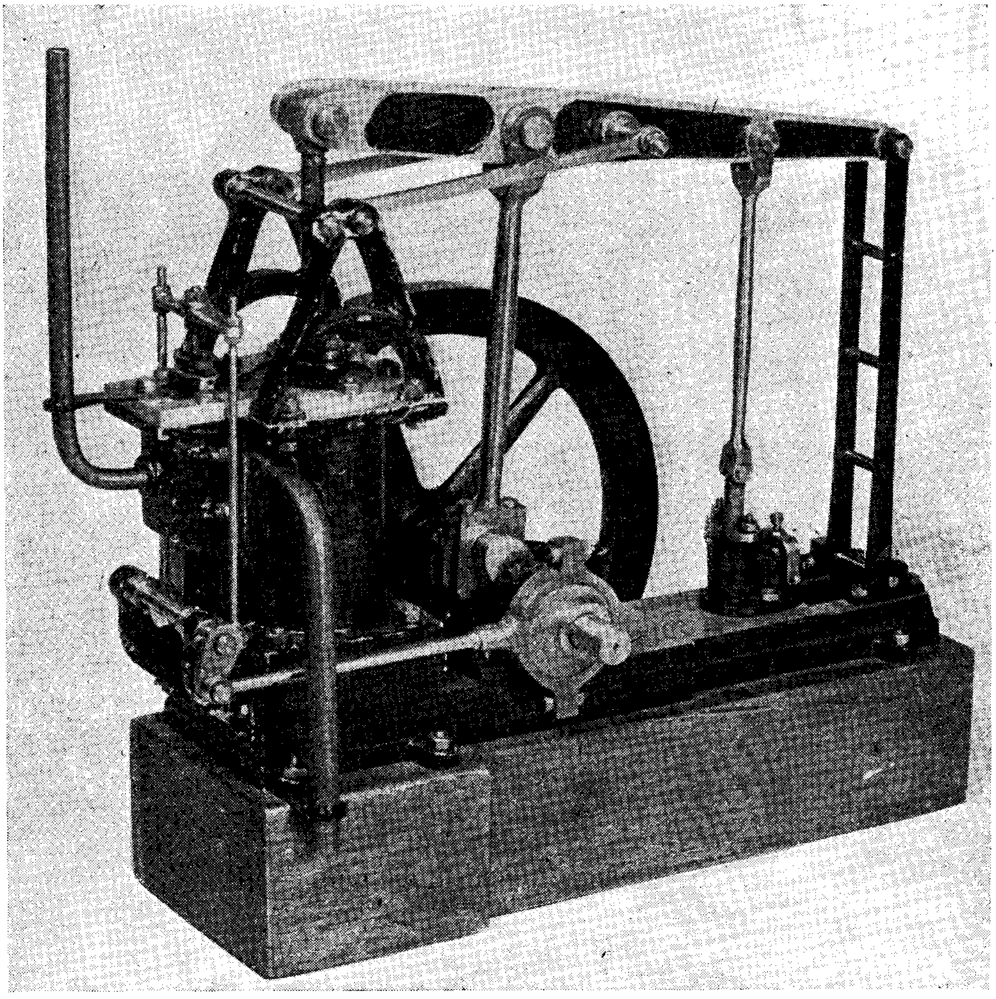
The performances of the new engines will be watched with interest. In order that as many different classes of traffic as possible, all over the Southern Region, may be utilised for testing without undue delay, five of the engines are being built. But we wonder what advantages they will offer to model engineers, and whether such a new design will prove satisfactory in miniature.

A BEAM ENGINE

Model of Easton and Amos "Grasshopper" steam engine of 1862

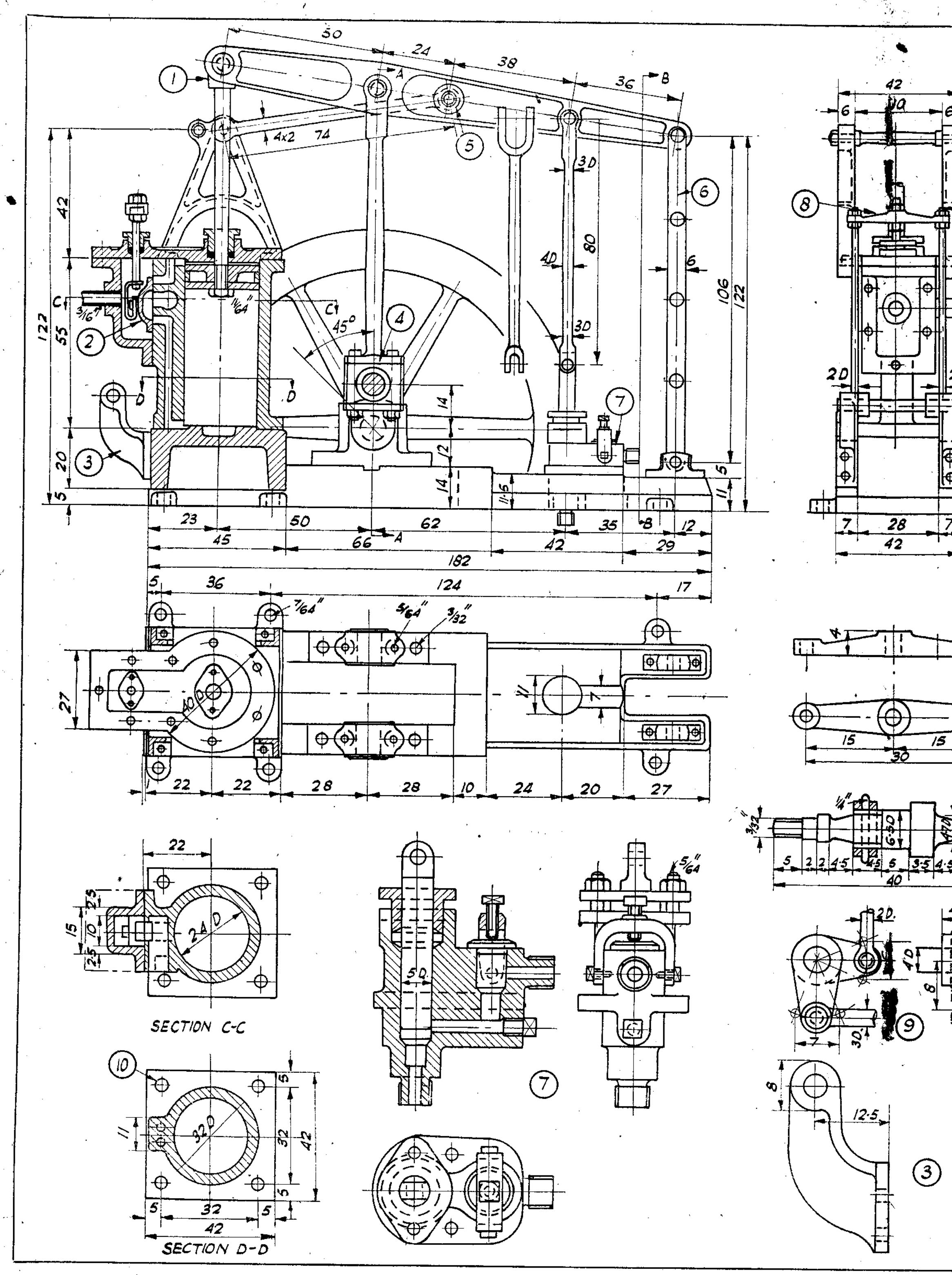
by A. Ebeltoft (Norway)

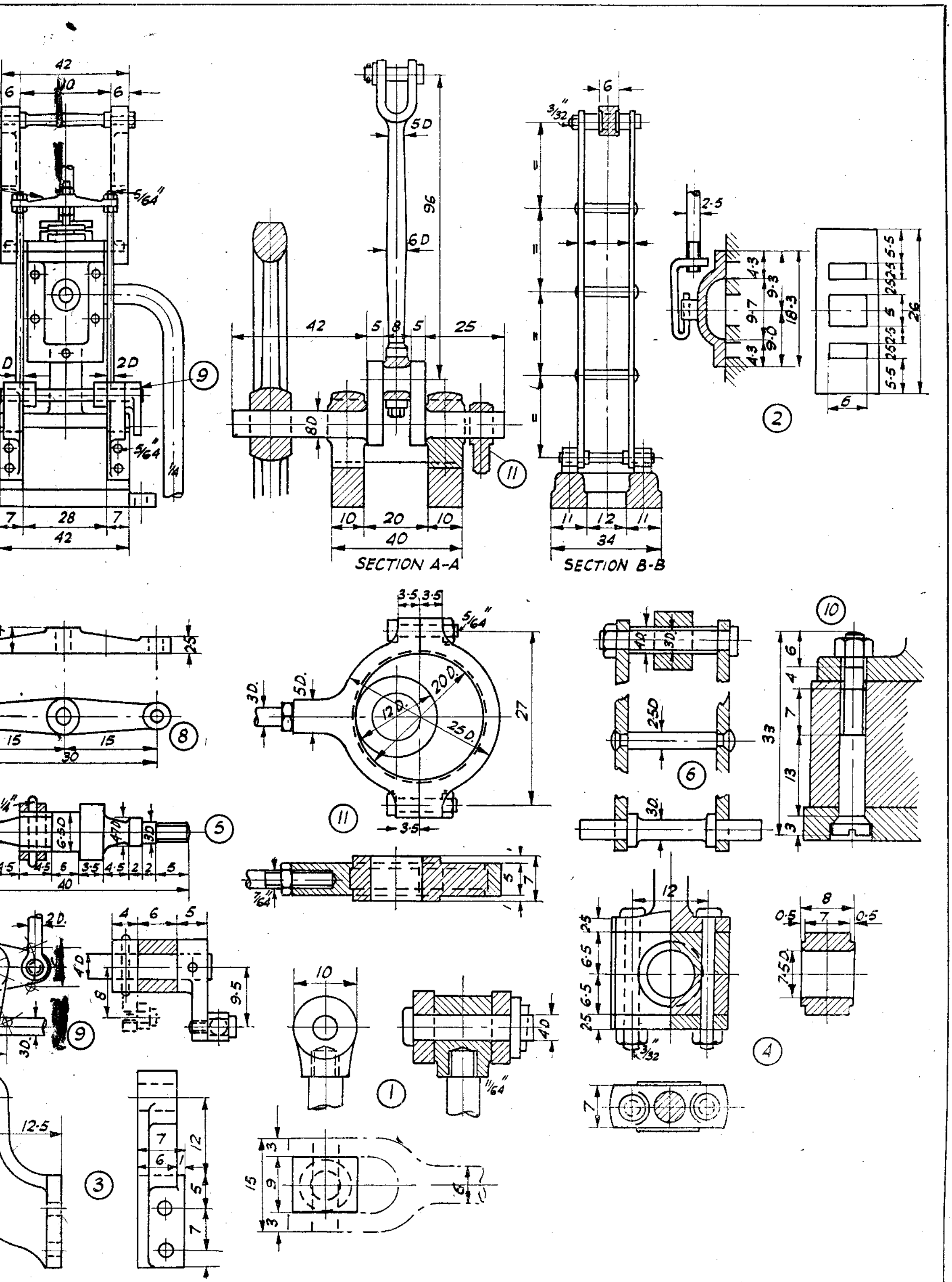
THE following will be required for the work besides the usual tools, a vice, etc., a lathe and (preferably) a small drilling machine, screw-cutting tools for the various sized screws used drilling will have extremely unpleasant effect in the final assembling of the engine. Special stress is laid on the need for absolute accuracy in the making of the slide-valve motion. Looseness



with corresponding taps—either English or mm. sizes—a special file for aluminium, various other round, flat and square files and a fine grinding tool, and a "Columbus" or a "Mauser" slide calipers. Pay attention from first to last to *accurate* work. Inaccuracies in planing or in bolts and bearings will have extremely unfortunate results when the engine starts working, as the slide-valves must be accurate to within 1/10 of a millimetre (minimum).

The foundation frame must be filed flat, first on its underside with a special file of about 10 in.


SECTION C-C
SECTION D-D


SECTION A-A
SECTION B-B
2
5
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A

Ordinary files cannot be used on aluminium alloys, as they "tear" and cause coarse scratches in the flat surface. The top of the foundation frame is then filed and constantly checked with the caliper gauge. The sides are then cleaned up to the necessary extent, which should not be much if the casting is fairly accurate.

The cylinder base is filed flat on its underside followed by the four vertical sides and constantly checked with the caliper gauge. Square up all angles. After this the four bolt holes should be *accurately* marked off, drilled and tapped 9/64 in. A piece of hard wood (teak or the like) for example about 2 cm. thick is planed flat on both sides and used to facilitate setting up the different parts on the faceplate of the lathe. (This naturally only applies to those who have not a more fully equipped lathe at their disposal. All amateurs are, however, not as fortunate.) With the aid of four wood screws of suitable size with 9/64 in. threads, the base is then screwed firmly to the wooden block which is then screwed on to the faceplate of the lathe in such a way that it can easily be moved radially in all directions. When the work has been correctly centred (which can be checked on the lathe), all screws are tightened up and the top machined as shown in the drawing.

The Cylinder

The sides of the bottom and top flanges are filed to the nearest accurate dimensions and the bottom flange is then filed flat, continuously checking it with the level and caliper gauges.

The bolt holes in the bottom flange are bored and tapped 7/64 in. Be careful to see that the holes line up correctly with those in the base.

The cylinder is now screwed from the back to the wooden block with four 7/64-in. screws, and bored. Take a light finishing cut to ensure the surface of the cylinder being smooth and even. The top flange is then machined and also the groove for the cover. The cylinder is then reversed and fixed by round-headed wood screws (two in each corner) to the wooden block, centred *accurately* and the bottom flange machined to fit the guide in the base. The total length of the cylinder must, of course, first be marked off so as to ensure both flanges being the correct thickness.

The slide-valve face is filed flat and checked with the caliper gauge. The steam and exhaust ports are drilled out first with 3/32-in. and $\frac{3}{16}$-in. drills respectively, and are then chiselled and filed to exact dimensions. Check the depth of the holes constantly whilst drilling, especially the long steam ports. Half a millimetre too long and the whole job will be spoilt!

Cylinder Cover

Make recesses in the wooden block for the two stuffing boxes and drill the hole for the piston-rod in the cover. Turn a mandrel down to the diameter of the piston-rod at one end, and with a shoulder, so that with the tailstock of the lathe it can press the cover up against the faceplate while it is being machined. Insert a couple of screws in the corners to help. The cover is then centred with the help of the mandrel, and its underside is machined. By means of a suitably shaped tool, machine the round part of the edge of the cover, first removing a little of the material with a file. (During this work move the faceplate backwards and forwards by hand.) The top is finished with a file. It can also be put on the lathe, centred with the mandrel, fixed by a couple of screws and a light cut taken across the top, drilling out the stuffing box in the same way. The rim round the valve chest is finally filed *together with* the valve chest flanges after the parts have been assembled.

When machining aluminium alloys, use a sharp tool with a slight clearance angle. This makes it easy to machine; it is also one of the reasons why such a simple method of setting-up can be used as that described here.

Eccentrics

In the material (an iron disc 8 mm. thick and about 25 mm. in diameter) drill the hole for the shaft, preferably a very little smaller ($\frac{5}{16}$ in. for example) than its diameter (8 mm.), as the hole has a tendency to become slightly larger during machining on the mandrel. First turn both sides and afterwards the groove itself on a new centre 3.5 mm. from the first at both ends of the mandrel. These must, of course, lie in the same plane, and in the absence of a better tool use two short straight-edges (see sketch I) and *line up* with these.

Eccentric Straps

These are first centred axially on the eccentric and the outer contours of the straps and the "neck" rough machined, but within fairly accurate limits. A transverse cut is made with a file across the material, the cut surfaces are filed accurately flat (right-angles!) and the two halves soldered together again. The bolt holes are then drilled; temporary bolts can be put in (tight fit) to serve as supports during further machining.

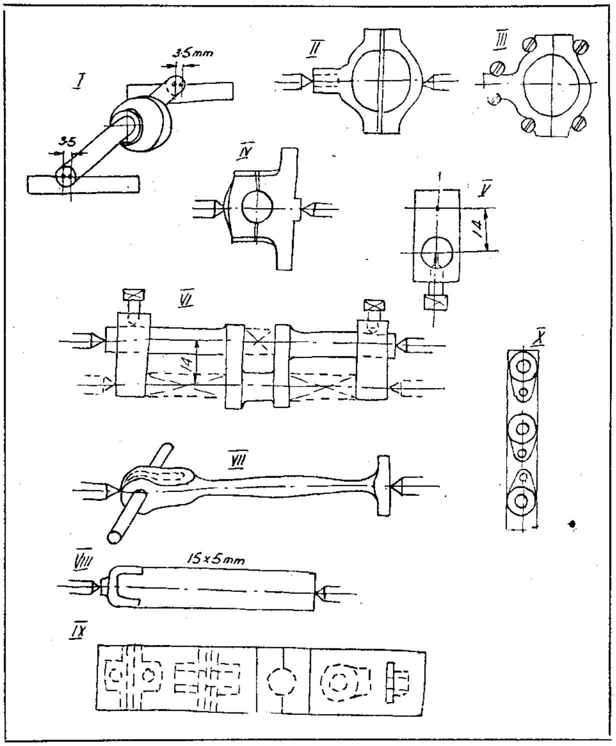
A $\frac{1}{4}$-in. hole is drilled in the material, and by means of a strong screw passed through this hole it is fixed to the wooden block; it is then centred and one side turned down, gauging the thickness by the neck of the eccentric-rod. The width of the strap is equal to the diameter of the neck. The material is then reversed and the other side machined in the same way. Use an intermediate layer so that the part which is not machined out in the middle, clears the wooden block. The strap is then fixed by six wood screws to the wooden block, again centred when the diameter of the eccentric sheave and the guide groove can be drilled (II and III). The solder is then melted and the strap cleaned up.

Shaft Bearings

These are first centred in the vertical axis of symmetry set up in the lathe and the soleplate machined on both sides. The flanks and top of the bearing are also machined. The latter so as to leave 2 to 3 mm. of the height which can be cut away with the file when facing up. The dividing line must pass accurately through the centre of the shaft. The two parts are then soldered together, the holes drilled for the bolts and temporary bolts inserted as described with reference to the eccentric straps. The lateral surfaces are rough filed at right-angles to the soleplate and the hole

for the shaft drilled with a $\frac{5}{16}$-in. drill. The bearing is on a $\frac{5}{16}$-in. mandrel and both sides are machined symmetrically about the central plane. Check continually with the caliper gauge. The profile of the flanks should be cleaned up with a small half-round chisel and a round file, as shown in drawing (IV).

The crank bearing is machined in the same way.



Feed Pump

True up the underside of the soleplate with a file and fix the pump to a piece of planed hard wood, bored out on its underside so that it stands perfectly straight in the drilling machine. Drill a 2.5 mm. hole through the cylinder and turn the accessible parts of the pump over and under the soleplate, using the hole as a centre. Also, mark off the centre of the delivery connection, reverse in the cylinder and rough machine. Then drill the cylinder, the stuffing box, the valve chest and the bore with a drill of suitable diameter. *The other small components of yellow metal,* such as the crosshead bearings for the "riser," stuffing-box glands, etc., are machined out of the material as indicated in sketch IX and need no further description. Use a mandrel and turn it where it can be turned (i.e. in the lathe).

Crankshaft

To turn this, two pieces of approximately 25 × 16 × 8 mm. flat iron will be needed. In one end, drill a hole slightly larger in diameter than the finished shaft, for example, 11/32 in. The shaft is then turned to the same diameter so that it can be pressed into the holes. It is best to insert a set-screw, to make sure that the parts cannot rotate on the shaft during machining, but they may also be soldered on and melted off again when the turning of the crankpin has been completed. The parts are aligned and adjusted before being secured so that the centre of the crankpin coincides with them (see instructions for turning the eccentric).

The crankpin and the inside faces of the crank arms are now turned; naturally, first drilling them and sawing or filing off the bulk of the material to be removed. Into the gap press a piece of hardwood, or better still a piece of metal (without using sufficient force to bend the crankpin) and then turn the shaft itself and the outside faces of the crank arms. Make sure the diameter of the shaft does not become too small when filing and cleaning up. It is easier to turn the shaft to fit the hole in the flywheel and eccentric than the other way round (VI).

Connecting-rod

File the material exactly at right-angles, and mark off centres for the cross-head pin and the drilling of the fork. Drill this first and insert a straight steel wire 6 to 8 cm. long and 4 mm. in diameter through the hole. This will serve as a check when drilling the forks, and the flanges on the ends of the rod will be kept at right-angles to the crosshead pin. The rod is then centred with the drilled holes as starting points (check all measurements with the caliper gauge) then machine and clean up with emery, after which the gap can be sawn in the fork and the rest filed as shown in the drawing. To protect the finished rod against scratches from the file, a copper wire can be wound round it during the work. (VII.)

Pump-rod

This is prepared in the same way. It is not so easy to machine accurately with forks at both ends and the small diameter. Go carefully, use a sharp tool and take a light cut to avoid bending the rod during the turning which would spoil the whole job!

Steam and Exhaust Pipes

These are made of copper tubing $\frac{3}{16}$ in. and $\frac{1}{4}$ in. respectively. Fill them with molten resin when they have to be bent. The first screws into the valve chest with a $\frac{3}{16}$ in. thread, the second pipe can be coated with a little red or white lead before being pushed into the exhaust port of the cylinder. *The other parts* hardly need further description for the skilled amateur.

Mention may be made of the advantage of simultaneously drilling the holes in the links,

blocks and riser cheeks by holding the parts together during the drilling with clamps or cramps so as to ensure the holes being exactly to size. The blocks are planed first on the insides until the thickness of the ribs is 1 mm. and the other sides as shown in the drawing. The superfluous piece for the cross-stay must naturally be cut away or filed off, and also the middle part at the foot. (This is merely to facilitate casting.) See also sketches VIII, IX and X.

It should be noted that the original engine of 1862 had a single crank and also one shaft bearing outside the flywheel, and the eccentric between the latter and the bearing on the base frame. It would be quite easy to build the model in this way if desired. (The model, which is in the Technical Museum in Bygdöy, is built in this way.) The construction shown in the drawing with a crankshaft makes a more compact model, but this is, of course, more or less a matter of taste.

For the Bookshelf

Modelling 4-mm. Scale Rolling Stock, by Michael Longridge. (*The Model Railway Constructor*, Velmead, Church Crookham, Aldershot, Hants.) Price 10s. od. by post.

The construction of 4-mm. scale model railway rolling-stock has been developed into something like a fine art, in the hands of a comparatively few experts of whom Mr. Longridge is one. These very small scale model railways are extremely popular today, and it is not surprising that, in recent times, several books have been published with a view to improving the general accuracy of dimensions and proportions which purport to be reduced to scale from the prototype.

This book deals very thoroughly with the whole subject and in an essentially practical manner ; it is fully and appropriately illustrated by instructive drawings and sketches, as well as some forty reproductions, on art paper, of photographs of excellent 4-mm. scale coaches, wagons and vans, showing clearly the very satisfactory degree of accuracy that can be achieved in so small a size.

Electricity in the Small Workshop, by Ian Bradley and Norman Hallows. (London : Percival Marshall & Co. Ltd.) Price 3s. od. net.

For a long time, there has been a need for a concise guide to the problem of fitting up an amateur's workshop with electric power and light, and this handbook seems to be exactly what was wanted. It deals simply and concisely with such subjects as : Power, Lighting, Heating and Wiring, and is amply illustrated by clear drawings, diagrams and photographs relevant to the subjects. Essential technical information is very simply stated, and there are frequent references to useful commercial appliances available on the market.

Simple Working Models, by C. E. Page. (London : Percival Marshall & Co. Ltd.) Price 3s. od. net.

The construction of working models with the simplest of tools and materials has fascinated people of all nations and ages from the dawn of civilisation ; presumably, this will always be so This little book describes the construction of seven different models for which no particular engineering skill or knowledge are required. The author's instructions are clear and concise, and provided that they are followed, success is assured, since all the models described have actually been made and work well. There is, however, plenty of scope for the ingenious constructor to develop his own ideas beyond those given in the book.

Forty Power Tools You Can Make. (Taylor Publishing Co., Sedgeford, Norfolk.) Price 12s. 6d. net.

This book consists of reprints of articles from the well-known American publication *Popular Mechanics*, which are reproduced by arrangement. It deals with the construction of machine tools for both wood and metal working, including lathes, drilling machines, circular saws, bandsaws and jig-saws, planers, band and disc sanders and grinders, besides a number of minor items of equipment. In nearly all cases these utilise various odd items of material, and components or assemblies such as old motor-car parts. The information contained in this book will be found of great practical assistance to the home mechanic or handyman.

Inexpensive Television. (Amalgamated Short Wave Press Ltd., 57, Maida Vale, Paddington, London, W.9.) Price 1s. 6d., postage 2d.

Although the subject of radio or electronics is somewhat outside the realm of model engineering, there are undoubtedly many of our readers interested in the construction of this kind of apparatus, and this little booklet will be extremely helpful in solving many of the problems which confront them in this class of work. Among other things, it discusses the possibility of utilising " surplus " components which are now available, including the selection of suitable cathode-ray tubes and valves. Most of the contents of the book appeared originally in the form of a series of articles in the *Radio Constructor*.

*The "Eureka" Electric Clock

by "Artificer"

A READER has pointed out a rather serious oversight in the details of the balance wheel which were described in the February 17th issue. It will be noted that the soft iron portions of this wheel are arranged to form a three-limbed electro-magnet, the limbs being connected by an iron clamp-piece at the top end, and by a brass clamp-piece at the lower end, so that the magnetic circuit is left open, except for the proximity of the armature plate below the wheel.

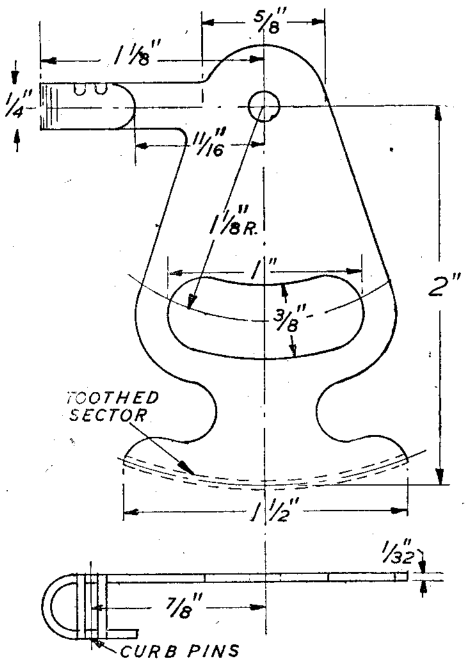


Fig. 14. *Regulator quadrant*

The object here, of course, is to produce the maximum attractive efficiency between the magnet poles and the armature, and to avoid the stray field which would be caused by an "open" magnet. This is all right as far as it goes, but the correspondent referred to has pointed out that when the bimetal rim is fitted to the balance wheel, the inner (steel) component of the rim will short-circuit the open poles of the magnet and cause a serious loss of efficiency.

As the clock which was restored is not now available for further examination it is impossible to say how this factor was dealt with in practice ; there is a possibility that the steel part of the rim was made of a non-magnetic alloy, or that a section of non-magnetic material was brazed in at the point adjacent to the lower clamp. It may be found rather difficult to obtain a suitable piece of non-magnetic steel to make the rim, but fortunately there is a much simpler method of eliminating the short-circuit, which will considerably reduce the loss of efficiency from this source, and can be applied even if the wheel has already been fabricated.

The remedy consists in counterboring or trepanning away the portion of the rim surrounding the core at the lower end, to a diameter of $\frac{5}{8}$ in., which will leave a clear gap of 5/32 in. all round the core. This operation can be carried out by means of a cutter mounted on a $\frac{5}{16}$-in. bar by a grubscrew, and does not necessitate dismantling the wheel, except for the removal of the core and the exciting coil. As the removal of this metal will affect the balance of the wheel, it may be replaced by a washer of brass or other non-magnetic material, which need not be positively fixed in place so long as it is prevented from rattling about when fitted.

Regulator Gear

In principle, the regulator of the "Eureka" clock is identical with that of any ordinary watch or balance clock, consisting of a quadrant mounted concentric with the balance wheel pivot, and capable of partial rotation around it, having an arm fitted with curb pins which control the motion of the hairspring near its fixed end,

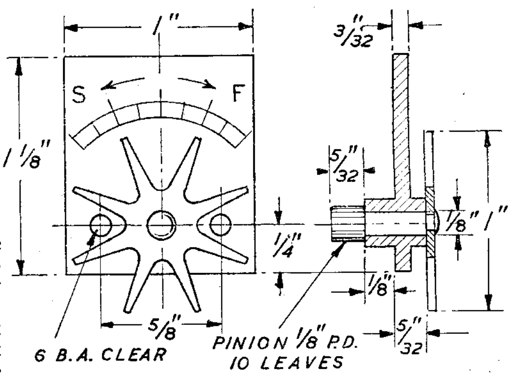


Fig. 15. *Regulator pinion, star wheel and rating plate*

and thereby influence the rate of vibration. The effect is virtually the same as altering the length of the hairspring, which could not be done in practice without putting the balance "out of beat."

The details of the "Eureka" clock regulator are given in Figs. 14 and 15, but it is considered

*Continued from page 331, "M.E.," March 17, 1949.

that they are needlessly elaborate, and confer no practical advantage over the simpler form of regulator as fitted to a cheap alarm clock. Only if it is desired to construct a faithful replica of the original clock is it considered worth while to follow these details exactly. It will be seen that the regulator quadrant is equipped with a

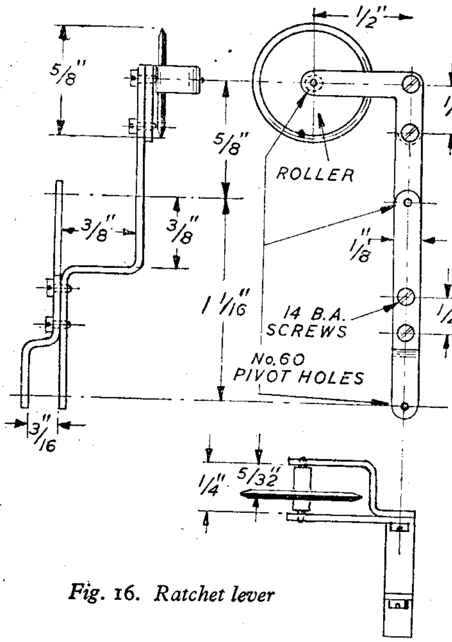


Fig. 16. *Ratchet lever*

toothed segment, engaging a pinion carried in a plate attached to the rear motion-plate of the clock, and fitted with a star wheel on the outside, by means of which it is operated. The quadrant plate has a ¼ in. pivot hole which fits over the spigot of the rear balance pivot housing, and is retained in place by fitting a washer over it and lightly burring over or expanding the end of the spigot, so that it moves with some friction. A curved slot is cut in the lower end of the quadrant, which is located by springing it into a slot at the root of the boss which clamps the end of the hairspring, and this boss also limits the motion of the quadrant, preventing the sector from moving far enough to get out of mesh with the pinion.

The arm extending horizontally from the quadrant is bent U-shaped at the end, and notches are cut across the span, into which brass curb pins approximately 1/32 in. diameter are sweated. Under working conditions, these allow a little play for the hairspring, which passes between them, and should touch each of them in turn as it expands and contracts with oscillation of the balance wheel. By moving the quadrant towards the anchorage of the spring, its effective free length is increased and the clock is slowed down; movement in the other direction has the reverse effect and increases the working rate.

If it is decided to simplify the regulator, it is suggested that the pinion, pivot plate and star wheel may be entirely omitted, also the toothed sector of the quadrant, but the latter should then have a second arm extending upwards for operating purposes. A rating plate may be fixed to the pivot housing to indicate the position of the arm, and show the direction in which it must be moved to produce a faster or slower rate.

Ratchet Lever

As already mentioned, this component was entirely absent when the clock was submitted for restoration, and has been produced from first principles, so there is no guarantee that it is identical with the one originally fitted. The form in which it is made is somewhat elaborate, involving the use of three separate parts held together by 14-B.A. screws, and a simpler construction, with the parts fabricated by sweating or riveting would serve just as well, but it should be noted that the construction was experimental and tentative, and several alterations were called for before it produced the desired result, so that a method of construction which conferred some measure of mutability was clearly indicated. (Fig. 16.)

The top end of the lever is extended at right angles to its main length and carries a large diameter disc roller, which is reduced to a narrow rounded edge and polished to reduce friction when in contact with the eccentric on the balance staff. This may be turned from the solid, as the more orthodox horological method of making it separate, fixing it to a brass collet, and mounting the latter on an arbor, confers no practical advantage, and entails much more work. Mild-steel, case-hardened on the working surfaces is a suitable material and easier to machine than a carbon steel which could be hardened and tempered. The pivots should be highly polished and made a little larger than the holes in the lever, which are broached to a working fit;

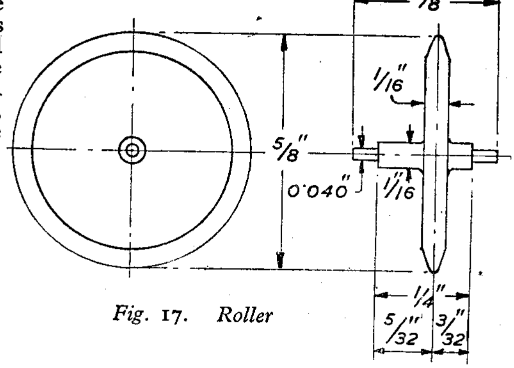


Fig. 17. *Roller*

this applies also to the other pivot holes for the feed pawl and the lever itself. (Fig. 17.)

Case-hardened mild-steel may be used also for the pawl, similarly turned from the solid, complete with its pivots, and filed to the shape shown. Before hardening, it should be tried out in position to check up on the shape of the point, which should fit the ratchet wheel teeth when at the end of its working stroke. The lever pivot

is a double-ended arbor which is a press fit in the boss of the front motion-plate, so that the lever straddles the plate when in position. Note that the feed pawl must be made tail-heavy, so that it is kept in engagement with the ratchet wheel by gravity. (Fig. 18.)

The backward movement of the ratchet lever, and the depth of " bite " of the pawl, are limited by banking pins fitted to the front motion plate; in the former case, the pin prevents the roller following the eccentric right to the bottom of its stroke, so that under conditions of variable balance action, the length of stroke of the pawl is fairly constant, or at any rate, never sufficient to enable it to gather more than one tooth of the ratchet wheel. But if, for any reason, excessive swing of the lever takes place, the second banking pin over the pawl prevents it rising too high so as to gather a second tooth or jam through engagement at too steep an angle. As it is very difficult to determine the exact positions of the banking pins beforehand, they are located as close as possible to their presumed positions and adjusted by bending.

The ratchet wheel is prevented from moving backwards, on the return swing of the ratchet lever, by a simple backstop spring, which, as already mentioned, is anchored by a screw to a lug cast on the motion plate, below the pivot bearing housing. This spring should be very light, or it will be noisy in action and also cause unnecessary friction in operating the ratchet wheel. A piece of pendulum suspension spring, bent at the end to the shape shown in Fig. 19, may be used for this purpose, and the hole for the anchoring screw may, with advantage, be elongated so that the spring can be adjusted to a nicety, to drop lightly into engagement with the teeth of the wheel as the ratchet lever comes to the end of its stroke.

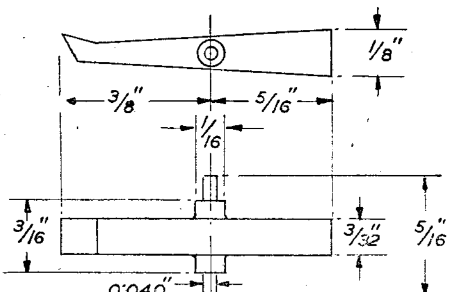


Fig. 18. Feed pawl

Wheel Train

The method of fitting the train of wheels in this clock is unusual, and it avoids the necessity of providing a pair of motion plates to accommodate both ends of the arbor pivots; but in other respects it is of dubious advantage, and probably causes more friction than the normal arrangement of wheels on arbors pivoted at both ends. As it is more than probable that any readers interested in the construction of such a clock will either utilise an existing wheel train, or have their own ideas on its arrangement, it is not proposed to devote much space to its description, but the spacing and numbers of teeth in the wheels and pinions are illustrated in Figs. 19 and 20, the latter being in the form of a diagram in which it is assumed that the pivots are in line vertically for the sake of clarity.

A rather peculiar, and in some respects inconvenient, feature of this wheel train is that the pitches of the wheels and pinions are not all the same; this has no doubt been done in order to

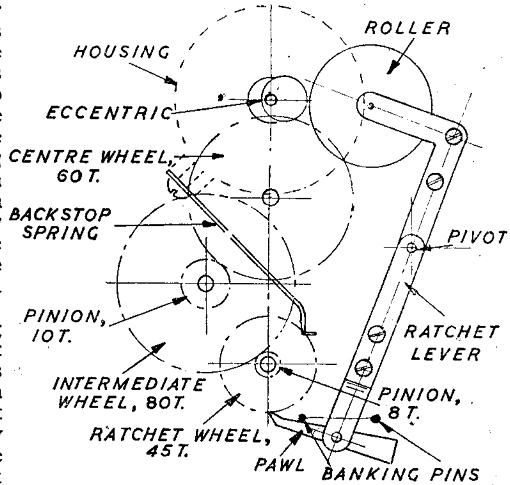


Fig. 19. Arrangement of ratchet gear and main wheel train

enable the " motion " wheel and pinion (that is, the intermediate element of the compound train required to reduce the speed of the hour wheel to 1/12 that of the minute wheel) to run on the same arbor as the intermediate wheel of the main train. But here again the advantage is questionable, and it probably would be much simpler, particularly for readers who have to collect suitable gears or cut their own, to avoid the use of " mixed " pitches. The intermediate motion wheel and its pinion would then have to be fitted on a separate fixed stud, as it is in most normal types of clocks. Apart from the motion work, which must obviously provide a 12 to 1 reduction, it is not imperative that the reduction ratio of the main train should be the same as that specified, providing that the number of teeth in the ratchet wheel is modified to produce the correct " count," and drive the train at the correct rate for accurate timekeeping.

It may be remarked that some " Eureka " clocks have been made with the gearing and motion work disposed differently to that of the example shown, and in this respect, constructors may exercise their own fancy or preference. The example dealt with has an open dial, fitted with two sockets which push over the spigot extensions of the armature plate studs, and are secured with grubscrews. The entire movement is mounted, by the lugs of the armature plate, on two vertical pillars, which are in turn bolted to the top of a hollow plinth which houses the battery—a large capacity single dry cell. A domed glass case is presumably intended to be fitted to protect the mechanism from dust,

though this was missing in the particular specimen.

Supporting Pillars

These are shown in detail in Fig. 21, and it will be seen that they are of composite form, and one of them is devised to form a conduit for the battery supply lead, so that the latter can be kept invisible, or at least unobtrusive. This is

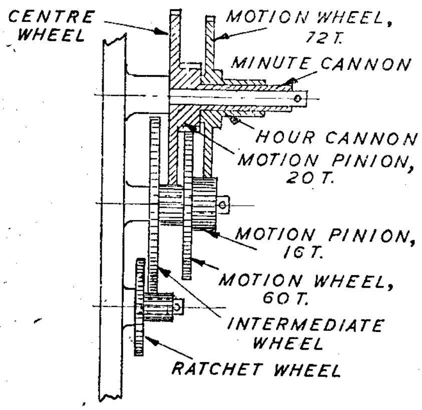


Fig. 20. Diagrammatic side view of wheel train

another optional feature, but many constructors would consider it simpler to machine the pillars from solid brass—with or without a drilled passage for the lead. Alternatively, one of the pillars, or its centre bolt, could be insulated and used as a lead-in conductor. The other terminal of the battery is of course "earthed" to the frame of the clock, and polarity of the connections is of little importance.

In the description of this unique and interesting type of clock, the writer has attempted to furnish sufficient data to enable the intelligent reader to build a clock working on similar principles, if not identical in detail. Many thanks are due to several helpers in this research, including Wing Commander J. Fitzpatrick Lewis, who first introduced the particular example to the writer's notice; to Mr. F. Hope-Jones, of the Synchronome Co., and the staff of the South Kensington Science Museum, for technical and historical data; and last but not least, to Mr. J. Message of the "M.E." Workshop, for assistance in the practical work of restoration, and preparation of notes and sketches.

Readers' Comments

Due acknowledgments are made to the many readers who have written to the writer or the Editor on the subject of the "Eureka" or other unusual types of electric clocks. Some of the letters express an adverse opinion of the clock or criticism of its design, but in nearly all cases they show real interest in the subject, and ask for further articles on similar topics.

It is not possible to publish all these letters in detail, or even to quote from them, but one or two have been selected by the Editor as containing matters of general interest, and will appear in the Practical Letters columns of THE MODEL ENGINEER in due course. One rather incoherent correspondent, however, has accused the writer of "cheap sneers" at the constructors of Hipp or other simple pendulum clock, though such a thing was certainly never implied or intended. It is true, as he points out, that such clocks are easy to build with simple equipment, and perform accurately and reliably; but this fact, so far from being denied by the writer, was clearly stated and indeed emphasised in the introductory article on the "Eureka" clock, together with the motives for bringing the latter to the notice of readers.

Another reader asks "what is the significance of the title 'Eureka' applied to this clock?" That is a matter beyond the cognisance of the writer, and might be answered by another question—what's in a name? But from hazy recollection of ancient history, the name recalls the legend of old man Archimedes tearing through the streets of Athens in nudist uniform, leaving a trail of soapsuds, and yelling "I have found it!"—on the memorable occasion when he hit upon the method of finding the specific gravity of metals. By inference, one may suppose that the emotions, though probably not the actions, of the

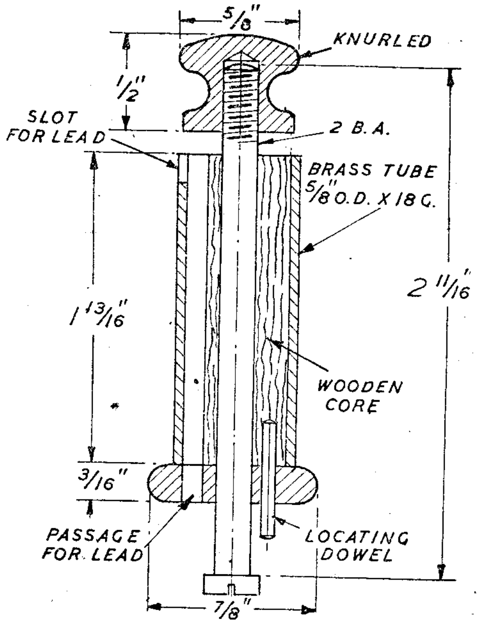
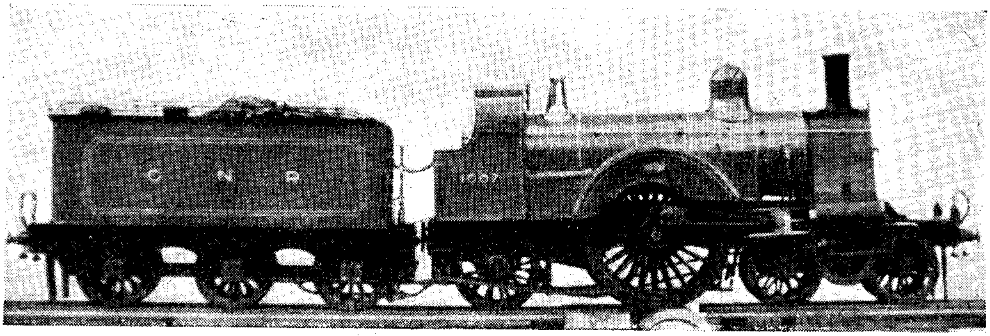


Fig. 21. Supporting pillars, 2 off (one only drilled and located to form lead conduit)

inventor of this clock were similar—in other words, he must have believed that he had really "got something." But carrying deduction still further, it is possible that after the disillusionment caused by the abortive efforts to exploit the commercial production of the clock, he may have had another search through the Greek dictionary to find the appropriate term for that much sadder phrase "I have had it!"



A 5-in. Gauge G.N. 8-ft. Single

by Major R. J. P. Briggs

THE small locomotive shown in the photographs was chosen in view of the fact that many "small locomotive" builders are building locomotives of the 4-6-2 variety, and it was felt that a model of one of the now "Old Timers" would be a change, and a reminder of boyhood days when the prototype was at its zenith.

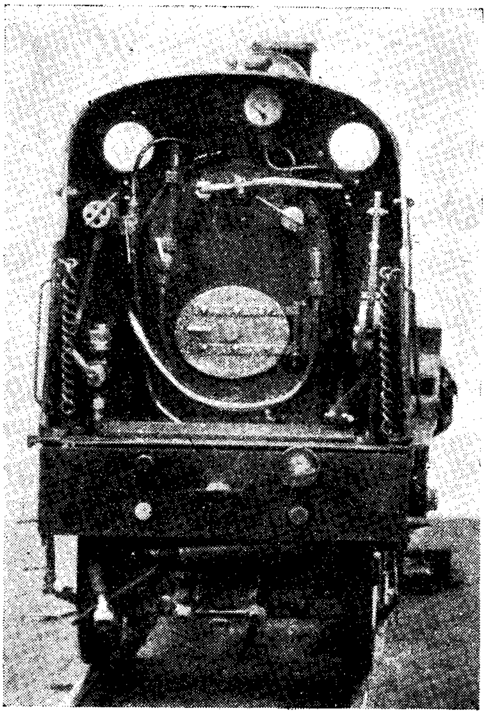
Therefore, one of Stirling's 8-footers modified by Mr. Ivatt with a dome, was chosen.

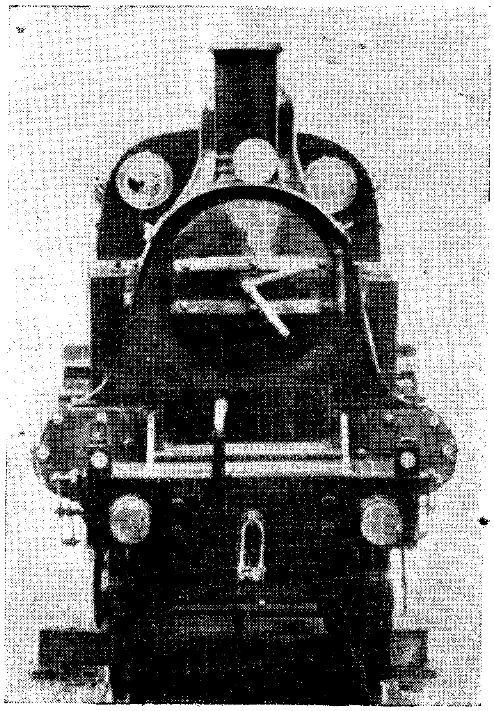
No drawings were available, so some were made, based on a small sketch found in Pettigrew Ravenshears *Manual of Locomotive Engineering* dated 1901. The drawings had to be made from memory and took 2 months in spare time, and steam was first raised 9 months later. Various details have since been added.

The only castings obtainable were a complete set of wheels from Messrs. Kennion, and excellent castings they were. With the exception of the wheels and boiler, all parts were fabricated from scrap, on a $3\frac{1}{2}$-in. centre gap-bed lathe, hand drilling-machine and a hand shaper, "Adept" No. 2.

The boiler design was based on "The Swindon Kettle" by our old friend "L.B.S.C." but was modified in many respects to fit in between the 8-in. driving wheels.

(*Continued on page* 396)



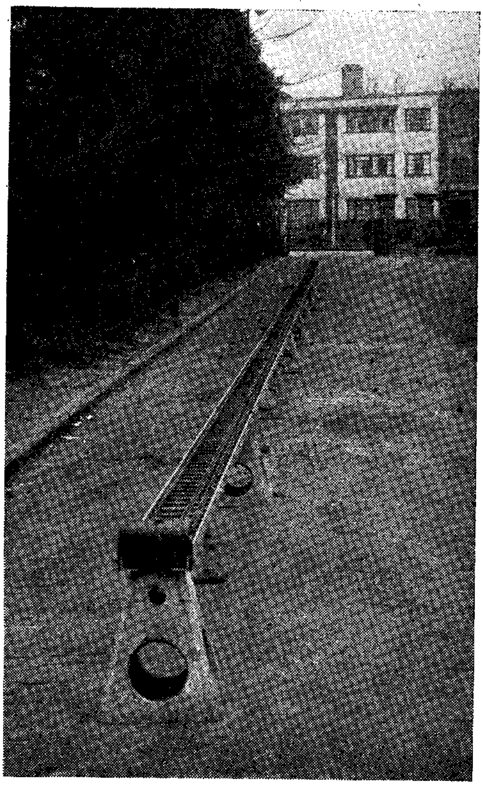


A Semi-Portable Multi-Gauge Track

by K. N. Harris

AFTER some years of borrowing other people's portable passenger-carrying tracks, usually the S.M.E.E. track, but occasionally that of our good friends, the Watford Society, we, the Kodak Society, decided that it was time we possessed one of our own. For my manifold sins, the designing of this track and the obtaining necessary materials fell to my lot. "Obtaining" in this connection is a useful omnibus word, for it covers a variety of means and methods!

When Mr. Crebbin and I were invited over to Belfast last spring for their Exhibition, we were most favourably impressed by their portable track in general, and some of its features in particular. They used concrete standards of a truncated pyramidal shape, or frustra of prismatic cones, if you prefer it, and this appealed especially to me as being at the same time rigid in the extreme and simple to produce on repetition lines from materials which are comparatively easily obtainable.



We decided upon a track which would carry a 7½-in. gauge engine, for two reasons: (*a*) 7¼-in gauge engines are not *too* uncommon and are hardly catered for at all, (*b*) a wide gauge of this nature is admirable for passenger-carrying trollies, giving an excellent factor of stability.

We were not particularly concerned with extreme portability, putting strength and rigidity much higher; therefore, in considering the design, we started out with the intention of using 2-in. × 2-in. × ¼-in. angle for our main longitudinal carriers. Poking around a scrap-metal dump, we found ten welded frames made from this material, each about 13 ft. long and 4 ft. wide, in excellent condition and practically free from holes, which we promptly bought. These, when cut up, supplied us with practically 130 ft. of carrying framing.

The Belfast system of supports was adopted with variations; I schemed out the concrete pillars on the hollow reinforced

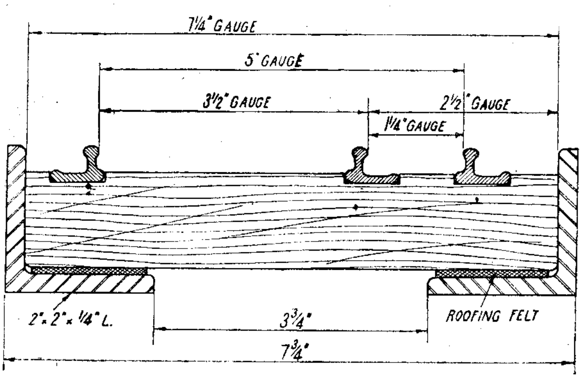


Fig. 2. *A cross-section of the track and frame*

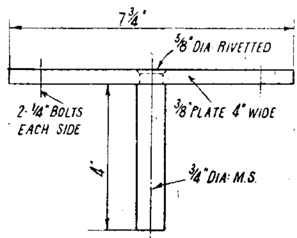


Fig. 6. *The intermediate supports*

principle, as detailed in Fig. 1, and one of our members made a first-class knock-down wood casting-box for them. Sets of reinforcing frames were made up to templates ready for the casting; actually, the pillars were cast at the rate of about one a week, which were merely a matter of convenience because "Track Night" was arranged every Tuesday.

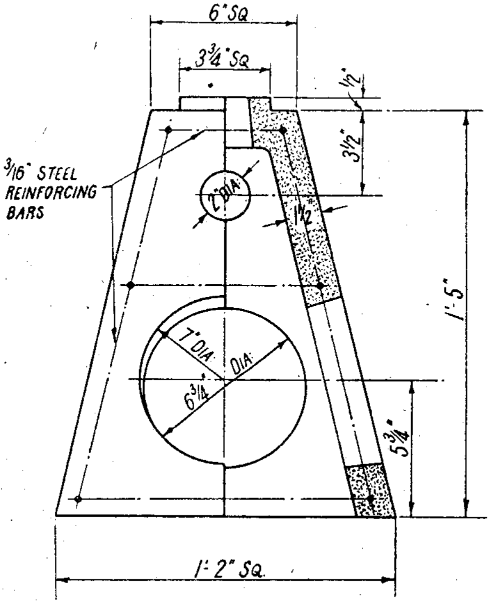
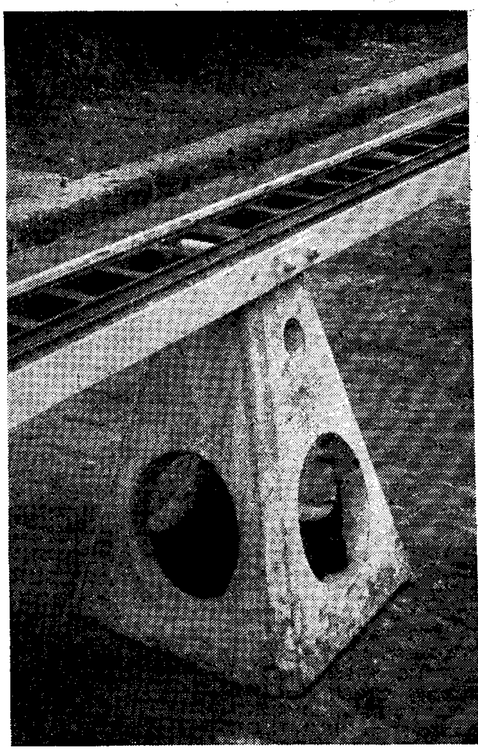


Fig. 1. Half elevation and section of the concrete pillars

Fig. 2 shows a cross-section of the track, and Fig. 3 a dimensioned diagram of the layout of a single section. Fig. 4 shows the method of jointing the sections one to another, and Fig. 5 the mounting on the standards, whilst Fig. 6 shows the intermediate supports.

An examination of Fig. 2 reveals that the intermediate rails are of a peculiar section. This section is, I believe, used for a kind of coping round cooking ranges, gas ovens, etc., and we found a supply of it in the scrap yard already referred to. In many ways it is a most convenient section, as its long leg offers good facilities for drilling for holding-down screws.

The sleepers were machine-cut and slotted for the rails and thoroughly creosoted before assembly. They are a fit endways between the vertical flanges of the angles, but rest on strips of



"Rubberoid" laid along the horizontal flanges. This is a tip I got from the Malden track, and an excellent one, too; it tends to promote both silence and just that degree of resilience which is desirable.

The whole or the ironwork was thoroughly scratch-brushed and given two coats of paint before assembly. The intermediate supports are made from ¾-in. steam-pipe with one end slotted to form a fork to engage with a cross-stay, and the other threaded for about 4-in. and fitted with a long socket, with a closed end; the threads were so cut that the sockets were an easy handfit.

When up against a stay and the socket screwed right *up*, its bottom is 1½ in. above the base-line of the concrete columns.

This allows of a piece of hardwood, 12 in. × 7 in. × 1 in. to be placed under the screwed socket to spread the load. These pads are thoroughly creosoted, and the threads of the support-pieces kept well covered with grease, *not* oil.

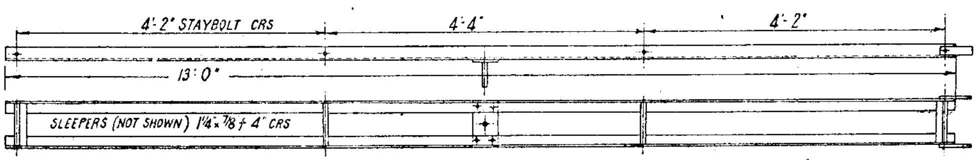
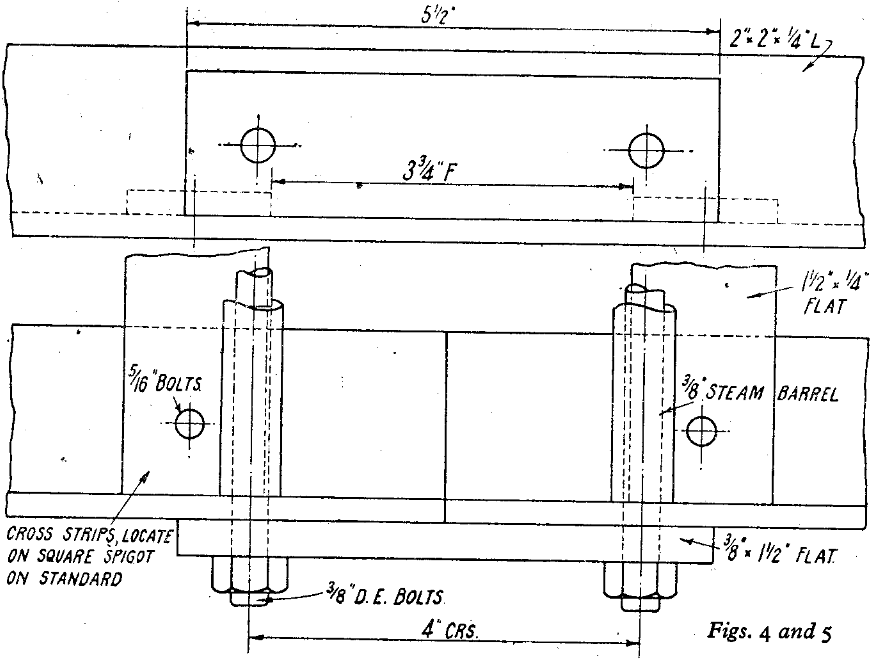


Fig. 3. Layout of a single section



Figs. 4 and 5

The finish of the track is: cement paint for the standards, battleship grey for the ironwork, and brown creosote for the wood sleepers.

Erection and dismantling are extremely simple operations and can be carried out quite quickly; owing to their solidity and the large area they cover, the concrete standards give a high degree of stability to the entire structure, whilst the 2 in. × 2 in. angles supported by main supports at just over 12 ft. centres with an intermediate stanchion support in between show no appreciable deflection under the heaviest loads likely to be imposed upon them.

The photographs will, I think, make clear any points not brought out in either letterpress or drawings.

The Society are eminently satisfied with their track now it is completed, possibly the more so as it is entirely due to their own efforts that it exists.

A 5-in. Gauge G.N. 8-ft. Single

(*Continued from page* 393)

Having no facilities for brazing a boiler of this size, the work was placed in the hands of Mr. Clarabut, with a fully-dimensioned drawing, and he produced a very satisfactory job, which steams well and justifies the design selected.

An auxiliary water-tube boiler is used to blow up the fire, anthracite being used for firing in the locomotive itself.

An eccentric-driven pump runs off main axle; a "Vic" injector is mounted in the cab, and a hand pump in the tender.

Stephenson link-motion is used, with a lever in usual manner.

A superheater with three elements in $\frac{7}{8}$-in. tubes is provided, with headers in the smokebox. Lubrication is by displacement from a tank between bogie wheels below and in front of the smoke box. A ring blower is used, as this was found to be more efficient than a single pipe with nozzle.

Cylinders are $1\frac{1}{4}$ in. bore × $2\frac{1}{2}$ in. stroke, made of Tungam, valve chests, valves and covers of gunmetal. Ports $\frac{1}{8}$ in. and $\frac{3}{16}$ in. × $\frac{3}{4}$ in.

Eccentrics are of mild-steel with phosphor-bronze sheaves. The regulator conforms to prototype, and is "Pullout" type as per Stirling, the valve itself being in the dome. The locomotive does not pretend to be a perfect scale model, but to give a reasonable representation of the prototype, which will, at the same time, give a good performance. With sand, a drawbar pull of just over 25 lb. has been registered.

All the preliminary testing has been carried out on a stand with the driving wheels contacting rollers 6 in. diameter driving by means of a bicycle-chain, an 18 lb. flywheel at one end of a shaft and a 5 lb. 6 in. diameter pulley at the other. A 1-in. flat belt is contacting the 6 in. pulley on a diameter, and a brake is produced by weights in the usual manner.

PRACTICAL LETTERS

A "Seal" Engine made in U.S.A.

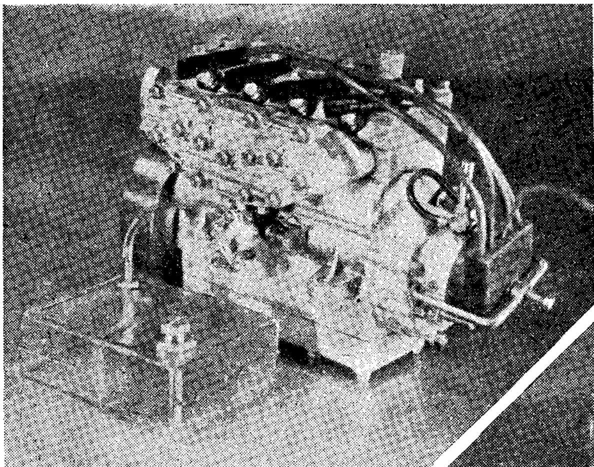
DEAR SIR,—Your readers may be interested in the enclosed photographs of the "Seal" marine engine made in my workshop.

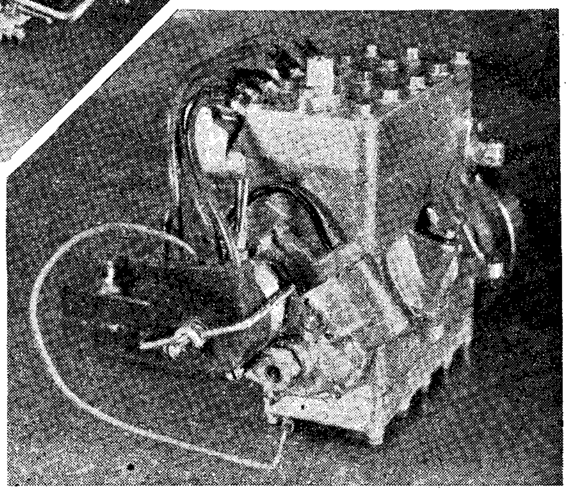
I prepared patterns from THE MODEL ENGINEER drawings and poured the castings in the foundry section of my shop. All lathe work I carried out on the small "Atlas" machine.

I found it less nerve-wracking to cast the manifold body solid, rather than to fuss with the small tolerance grooves, subject to foundry shrinkage. The exhaust and intake slots were subsequently milled out under metric guidance of the cross and vertical slides, and at the same set-up all bolt holes were drilled.

You may recognise the gas tank as a plastic cigarette package holder, with the top cemented permanently in place.

With careful aligning, I successfully bronze-bushed the timing gear cover for the camshaft to prevent positively entrance of oil to the breaker point housing. The crankshaft hole in the gear cover is also bronze-bushed.





Two views of Mr. Warren W. Lacey's "Seal" internal combustion marine engine

I made a few changes in detail to suit my own convenience. As you will see, my engine is the mirror image of the original drawings, to conform to American engine custom. The water inlet is placed on the side of the block to get it out of the way of the wheel in starting. The flywheel is aluminium alloy with a steel rim to provide weight where it counts. I drilled holes allowing communication between the crankcase and the valve stem chamber to provide free lubrication for the latter.

All structural members are poured from aluminium alloy from war surplus aircraft castings. The rods are cast in one piece, bronze, and the pistons of automobile piston metal with the internal shape and bosses core-formed. The piston rings (two per cylinder) are machined from solid cast-iron.

The engine runs smoothly and without hesitation at moderate and high speed. I am unable, as yet, to throttle down to idle without stalling. I suspect my carburettor throat is too large in bore.

I have, heretofore, been a steam enthusiast exclusively, and since this is my first attempt at an internal combustion engine, I am quite pleased with the result. I feel that this is due mainly to the excellence of the design. I encountered fewer errors or inconsistencies in the drawings than one ordinarily expects to find. I was particularly fascinated by the straightforward and highly satisfactory jig described for the camshaft.

Yours, faithfully,

Queen's Village 8, N.Y. WARREN W. LACEY, JR., M.D.

Home-built Refrigerators

DEAR SIR,—In reply to Mr. Firth's letter in THE MODEL ENGINEER of March 3rd last, there are, I am sure, many amateur-built refrigerators working, but the difficulty is that the makers, and particularly those who really do know, will not come out in the open. When I wrote quite recently on my own unit, I had one or two interesting replies.

Mr. Firth does not give the size of his evaporator or his cabinet, but I wonder if his zig-zag grid is big enough for the job it has to do. I used Mr. Meyland Smith's evaporator, but it is not by any means difficult to construct; I should not care to have one with less capacity. My insulation was only 1½ in. thick made of granulated cork, and this is clearly insufficient, for the whole cabinet sweats in hot weather. A cork expert tells me that I should have used a special black cork which is supplied for the purpose. If frost does not form on the pipe for 20 minutes from starting up, I would say there is something very wrong, for mine starts to get white within 1 minute, and the whole evaporator follows suit very soon afterwards. I doubt, too, if the inside temperature should rise 10 deg. before the motor cuts in. It should show little variation, unless the door is left open or a lot of new stuff put in. I cannot detect any difference on my thermometer before cutting in. To keep the cabinet below freezing point all the time is asking for a lot of running, and I think the commercials reckon on about 40 deg.

Gas pressure varies with outside temperature. The pressure for methyl, given me by a refrigeration engineer, were 50-70 lb. on one side and 10 to 15 lb. on suction. I agree on the former but can do no good with the latter. If I use 10 lb. even, the unit will run almost continuously with a lot of white frost, but not cold enough and a loud liquid knock from the compressor. Directly I go back to about 3 lb. all is well, and the unit runs for about 3 minutes before cutting out.

Any small leak can be found eventually with very soapy water, going over every joint whilst under pressure.

If Mr. Firth likes to write to me direct, I feel well qualified to "entertain him with various snags." The only one I have not been able to overcome so far has been the delay in the opening of the automatic valve, which results in so much oil being pumped out of the compressor working on so low a pressure.

Yours faithfully,
Churchill. J. W. GRAZEBROOK.

DEAR SIR,—Being in the refrigeration business, I am interested in the points raised by Mr. E. V. Firth in his letter in THE MODEL ENGINEER March 3rd, 1949.

I should say that his refrigerator is working about twice as long as it should do, some of this loss is probably due to an inefficient compressor, but I think most of it is due to the combination he employs.

I am assuming he is using a constant-pressure expansion valve, as used in THE MODEL ENGINEER design, as he says that his machine "follows the usual lines." Actually it is not now considered desirable to use this type of valve except under certain circumstances, as this valve cannot adapt itself to varying conditions of working, in other words it is suitable only for a constant load.

The reason being that as the pressure of the refrigerator varies with the temperature, any increase in temperature (due to increase in load such as opening door), will cause the pressure in the evaporator to increase, thereby closing the expansion valve, causing a restriction in the flow of refrigerant, just at a time when more is needed. This, coupled with the type of evaporator used, which having a large cooling surface, would be very sensitive to temperature changes, would account for the general inefficiency of the machine.

I note that a temperature of 30 deg. F. is mentioned. This is far colder than is required for domestic use and would need 6 in. of cork-board insulation to prevent undue loss.

With regard to the loss of refrigerant, it is usual to employ a special leak detector lamp for methyl-chloride, and with a very small leak, as in this instance, it would be almost impossible to locate it without.

The question of pressures of the refrigerant is rather involved; the efficiency and speed of the compressor, the efficiency of the condenser, and the temperature of the cooling air flowing through the condenser, the amount of work being done by the machine, and the presence of air in the system all affecting the discharge pressure of the compressor.

Assuming there is no air in the system, and everything else is normal, the pressure for methyl-chloride at 65 deg. F. would be approx. 85 lb. per sq. in.

With a constant-pressure valve, the suction pressure would, of course, be the same under all conditions, the pressure only being altered by adjustments to the valve. For a domestic cabinet, a pressure of from 10 lb. to 14 lb. per sq. in. with the same refrigerant would be about right.

I hope this advice will be of assistance to your correspondent and shall be pleased to give any further help that I am able.

Yours faithfully,
Maidenhead. MARCUS F. DAVIS.

Locomotive Tyres

DEAR SIR,—The article "Bouquets and Brickbats" in your October 28th, 1948, issue appeared to be an authoritative criticism, until I encountered the extremely misleading statement about locomotive tyres—"It is well known that in full-size practice the tyre itself is of tougher steel than the wheel centre and that this tyre is pressed on hydraulically to the steel wheel, thus constituting two entirely separate parts."

Now, it is well known that tyres (in railway practice) are not pressed on hydraulically. They are in fact shrunk on, and this is usually remembered even by the casual visitor to a locomotive works, who even when understanding little else, can recognise the tyre heating gas ring as being just a big brother of the ordinary domestic model.

For this effort I think R. W. Dunn surely deserves to have the largest of his brickbats hurled back at him.

As there may be some lack of knowledge of railway practice in the assembly of wheels and tyres, this is perhaps a good opportunity to give a summary of the practice existing on the railway which is still best known as L.M.S.—and will be found to differ only slightly on other railways.

First, tyres. These are turned internally to a smaller diameter than the wheel centre. The interference is calculcated from the formula

$$\frac{D \text{ (inches)}}{1200} + 0.005 \text{ in.}$$

Thus for a 60-in. diameter wheel, the tyre would be turned internally 59.945 in., giving an interference of 0.055 in.

The tyre is heated (and, of course, expanded) in a shallow pit, surrounded by a segmental gas ring, the required temperature being 240 deg. C.—below any critical temperature which would affect the properties of the material. The gas ring segments are then withdrawn, and the axle and wheel centre assembly lowered on to the tyre from a crane. Shrinking can then be effected by water or by natural cooling.

Secondly—crankpins, wheel centres and axles. Crankpins are pressed hydraulically into wheel centres, and wheel centres are pressed hydraulically on to axles. In each case it is specified that a pressure of 10 to 12 tons per inch of diameter should be exerted. The wheel boss will, of course, stretch under this effort, and so the interference of approximately 0.002 in. per in. of diameter, varies according to the stiffness of the boss. A 9-in. diameter axle will thus have an interference of approximately 0.018 in. in the wheel boss.

During the process of pressing, the entrance to the hole, and the leading end of the pin, have more work done on them than other portions of the assembly, and thus it is found that the entrance to the hole becomes stretched or scoured, and the leading end of the pin may also become scoured. Various dodges are tried in engineering practice to ensure that a constant pressure is exerted between the two pressed members at all points in contact. Stepped diameters are common in cylinder and valve liners, but in axle and crankpin assembly it is found that the most satisfactory results are obtained by using a slightly tapered crankpin or axle in a cylindrical hole. The taper is 1 in 500—thus a 7-in. diameter axle would taper 0.014 in. in its length.

This taper in conjunction with the interference fit ensures better results in practice than the old method of employing cylindrical pins in cylindrical holes.

Yours faithfully,

Crewe. DENIS R. COUPE, A.M.I.Mech.E.

CLUB ANNOUNCEMENTS

Islington Model Locomotive Society

The workshop has been redecorated during the end of term recess. We now have a new 3½-in. Myford and two 4-in. lathes, two drilling machines, grinder, etc., and a full complement of hand tools and accessories, together with plenty of raw material and spare vices.

Nine locomotives have, so far, been completed. They are all "live steamers," from 3½-in. gauge downwards, 2½-in being the most popular. Some are first attempts, ably guided to their successful conclusion by our friend and instructor, Mr. Bennett, late of "Bonds." Negotiations are at present under way for an extensive site for the erection of a multigauge track.

The class meet at 7 p.m. every Wednesday and Thursday at Blundell Street L.C.C. Evening Institute. Bus stop Brewery Road, off the Caledonian Road.

A very cordial welcome is extended to all prospective members, be they beginners or lone hands.

Hon. Secretary: J. H. WHISTON, 101, Marlborough Road, Holloway, N.19.

The Wicksteed Model Yacht and Power Boat Club

The above club will be holding their annual power boat events on Sunday, July 3rd, these being:—

Timpson Trophy. A Class, 1,000 yds. (Now held by Mr. Williams, *Faro*, Bournville.)

Newman Loake Cup. A Class, 500 yds. (Now held by Mr. Williams, *Faro*, Bournville.)

Perkins Cup. B Class, 500 yds. (Now held by Mr. Dalziel Bournville.)

Whitworth Cup. Steering Competition.

Hon. Secretary: J. G. SKEWS, 3, Lyveden Place, Kettering.

Eltham and District Locomotive Society

The next meeting will be held at the Beehive Hotel, at 7.30 p.m., on Thursday, April 7th, this will be the annual general meeting. It is earnestly hoped that all members will make a special effort to be present on this occasion.

At the last meeting Mr. Hutton gave his very interesting talk on "Dynamometer Cars" which was greatly enjoyed.

Bookings for the society's track at sports days and garden fetes are now coming in, and organisers are asked to make early application to avoid disappointment.

Visitors are cordially invited to attend the meetings.

Hon. Secretary: F. H. BRADFORD, 19, South Park Crescent, Catford, S.E.6.

The Bristol Society of Model and Experimental Engineers

At our meeting on Saturday, March 5th, we had the pleasure of listening to a talk by Mr. J. J. Chantrill on "Radio Control of Models" and a demonstration of control with an excellent model of a destroyer, which Mr. Chantrill had made himself. Our members were extremely interested in this demonstration and extended hearty congratulations to Mr. Chantrill on his achievements.

Hon. Secretary: C. C. LUCY, 28, Bilbury Crescent, Henleaze, Bristol.

Edinburgh Society of Model Engineers

There was a large attendance of members and friends at a visit to the Museum workshops arranged through the courtesy of Mr. Hutchison and his staff, to whom we are indebted for a very interesting evening.

The power boat section is now in full swing and all interested are advised to contact Mr. Drummond, the convenor. Sailing rights have now been adjusted for Inverleith Pond with the other clubs who have promised close co-operation.

The workshop at 1A, Ramsay Lane, Castle Hill, Edinburgh, is now open on Tuesdays and Thursdays from 7.30 p.m. and also on Saturday afternoons from 3.30 p.m.

Hon. Secretary: JAMES H. FARR, Wardie Garage, Ferry Road West, Edinburgh, 5.

The Axminster and District Model, Experimental and Photographic Society

The annual general meeting of the above society was held at the headquarters, and was well attended. The committee and all present were unanimous in that they had reason to be well satisfied with the past year's activities, which had consisted mainly of extensive work on the large building consisting of a lecture hall, as well as "dark rooms" and workshops. In addition to this, a successful exhibition was held in October of last year.

Two useful pieces of equipment in the shape of a 3½-in. B.G.S.C. lathe and a photographic enlarger (both new), as well as benches, etc., were ready for use by members.

It was decided that work should be started on a club model, which is to be a 3½-in. gauge locomotive—"Juliet," castings for which have been presented to the society by a member, Mr. G. T. Adams.

Hon. Secretary: S. F. SALWAY, Beaumont, Castle Hill, Axminster, Devon.